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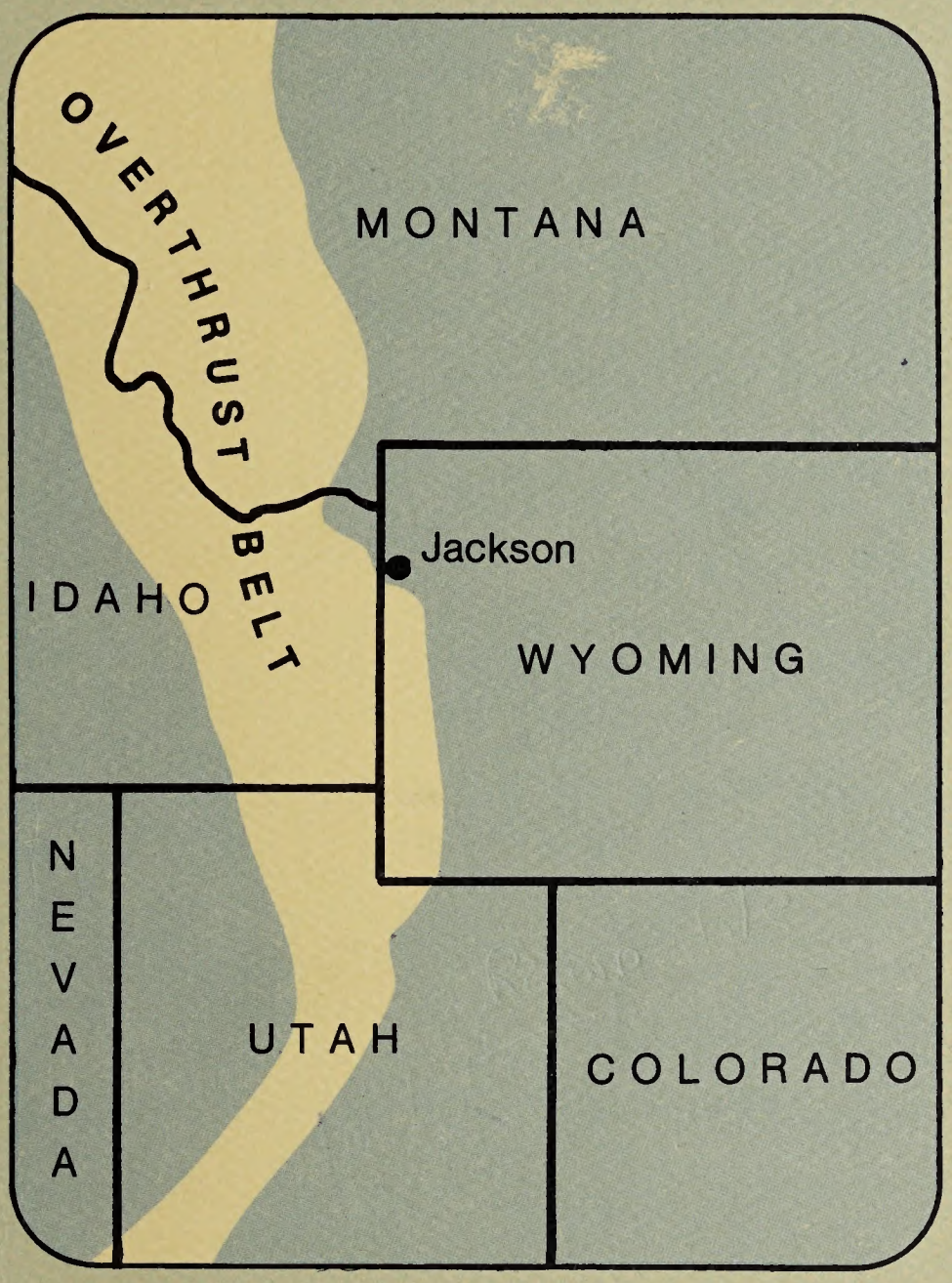
Cache Creek–Bear Thrust Environmental Impact Statement



PROPOSED OIL AND GAS DRILLING NEAR JACKSON, TETON COUNTY, WYOMING

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
BRIDGER-TETON NATIONAL FOREST

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United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VIRGINIA 22092

August 17, 1981

TO ALL REVIEWERS:

Enclosed is a copy of the Draft Cache Creek-Bear Thrust Environmental Impact Statement (EIS). Written comments will be accepted for a period of 60 days subsequent to the 17th of August 1981. All substantive comments received will be considered in preparing the final EIS on the two oil and gas drilling proposals addressed herein.

Oral and/or written comments will be received at public hearings to be held on September 21, 1981, from 7 p.m. to 10 p.m. and on September 22, 1981, from 9 a.m. to 11:30 a.m., 2 p.m. to 4 p.m., and 7 p.m. to 10 p.m. at the Snow King Inn, Jackson, Wyoming. The hearings will remain in session until all testimony has been given. Anyone wishing to make oral presentations at the hearings should submit his or her requests in writing to John Matis, Task Force Leader, U.S. Geological Survey, Box 25046, Mail Stop 609, Federal Center, Denver, Colorado 80225, or telephone him at (303) 234-4666. Other written comments on the Draft EIS not related to the public hearings should also be submitted to John Matis.

Please retain your copy of the Draft EIS for future reference. It will not be reissued. The Final EIS will consist of a supplement to this draft document.

Cache Creek-Bear Thrust EIS No: DES 81-33.

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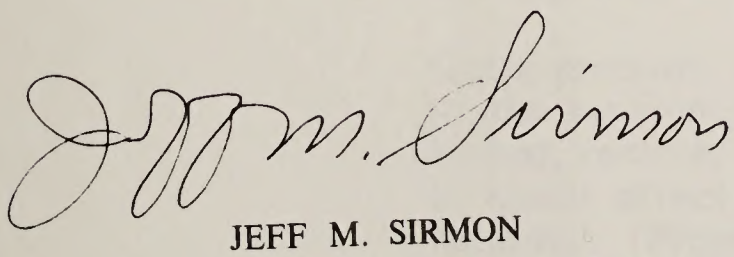
CACHE CREEK–BEAR THRUST ENVIRONMENTAL IMPACT STATEMENT

PROPOSED OIL AND GAS DRILLING NEAR JACKSON, TETON COUNTY, WYOMING

Prepared by

U.S. Department of the Interior, Geological Survey

U.S. Department of Agriculture, Forest Service



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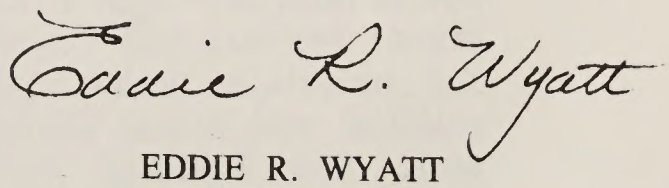

EDDIE R. WYATT
Acting Assistant Director for Resource Programs
U.S. Geological Survey

Retain this draft EIS for use with the final statement

1981

COVER SHEET

DRAFT ENVIRONMENTAL IMPACT STATEMENT
BRIDGER-TETON NATIONAL FOREST
TETON COUNTY, WYOMING

Responsible Agencies: USDI Geological Survey
USDA Forest Service

Proposed Actions: Approval of: 1) an application for permit to drill (APD) an oil and gas exploratory well in the Cache Creek Unit submitted by the National Cooperative Refinery Association (NCRA) and 2) an APD in the Bear Thrust Unit submitted by Getty Oil Company (Getty), both located near Jackson, Teton County, Wyoming.

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Abstract: NCRA's proposed drilling would be accomplished by constructing a road to the wellsite via the Game Creek access alternative. The USGS-FS prefer this option over the Cache Creek route as it would eliminate the problem of truck traffic through residential areas and interference with recreationists in the lower, heavily-used portions of Cache Creek. The Game Creek route could also serve as an access route for field development. The initial well would result in a 12- to 18-month temporary disturbance, with no long-term adverse environmental consequences. Approval of an initial well would permit inventory of any oil or gas present, and provide a basis on which to more fully evaluate environmental-economic tradeoffs of field development.

Getty proposes to drill an exploratory well on a high mountain divide in the recommended Gros Ventre Wilderness. The current undisturbed, remote, roadless character of the area would be altered, but it would affect very few people and generally avoid key wildlife habitat. Proper management of personnel involved with field development would mitigate or minimize most adverse impacts. After extraction of the oil/gas and rehabilitation, the area could again be managed as wilderness. The USGS-FS recommend approval of Getty's APD, with the use of Little Granite Creek road access alternative. Helicopter mobilization for the exploratory phase was studied by the USGS-FS. It was not recommended, however, because of the high costs and unknown geologic conditions which could complicate the drilling operations.

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SUMMARY

This EIS describes two proposed oil and gas drilling applications in the Bridger-Teton National Forest: 1) NCRA's APD in the Cache Creek Unit near Jackson, Wyoming, and 2) Getty Oil Company's APD in the Bear Thrust Unit. The U.S. Geological Survey (USGS) and the U.S. Forest Service (FS) jointly studied these drill requests. A series of reports was prepared by Government personnel and private consultants to document and analyze various aspects of the Cache Creek-Bear Thrust EIS. These supplementary reports were used to develop many of the analyses in the EIS and are available for public review at several repository locations. Well over 1,000 private individuals were personally contacted or consulted for information on technical aspects by project scientists during the course of this EIS investigation.

The three Federal oil and gas leases held by NCRA (W-20066, W-20067, W-20068) were issued in 1969, prior to enactment of the National Environmental Policy Act. No special restrictive stipulations were attached to these leases giving the Secretary of the Interior authority to prohibit absolutely all development activities on the leases, i.e., a no surface occupancy stipulation. NCRA's leases did, however, include a requirement to comply with the Krug Memorandum (a Secretarial/procedural order) and the Jackson Hole Area Oil and Gas Lease Stipulation (which prescribes certain environmental mitigating measures). Copies of both the Krug Memorandum and the Jackson Hole Stipulation are included in Appendix B. Implications of the Krug Memorandum are discussed in several locations in the EIS, particularly on page II-3.

NCRA indicated their interest in the Cache Creek area as early as 1972. Land use planning by the Government delayed matters until 1977, when NCRA's Cache Creek Unit was approved, and when they filed the APD being discussed in this EIS. High oil prices as well as oil and gas discoveries in the Overthrust Belt during the 1970's may have further influenced NCRA to pursue the Cache Creek prospect.

The legal question of whether or not the Government could disapprove an APD remained unanswered until recently. Controversy over the Cache Creek drill request prompted legal research by the Department of the Interior. This in turn formally brought the legal situation to light for the first time. The USGS-FS learned that they could not administratively disapprove NCRA's APD on environmental grounds because NCRA's leases did not contain language providing for such an action.

The Bear Thrust Unit leases are held by many different individuals and contain a variety of lease stipulations, which generally are permissive in nature (i.e., regulating how drilling should be done, but not whether it can be done at all). Most of the leases contain a proviso requiring RARE II-type studies prior to granting final APD approval. All of the Bear Thrust leases are covered by the Krug Memorandum and Jackson Hole Stipulation. The Cache Creek-Bear Thrust EIS accomplishes the type of NEPA review intended by these stipulations and augments work done under the RARE II program.*

---

*FS acronym for Roadless Area Review and Evaluation, a USDA study program to reexamine previous inventories and evaluate FS roadless areas in order to determine which lands should be added to the Wilderness System.

Description of Proposals

Cache Creek Unit exploratory well (NCRA).--The National Cooperative Refinery Association (NCRA) submitted an APD for a wildcat oil and gas exploratory well on their Cache Creek Unit in October 1977. The Cache Creek Unit comprises three leases held by NCRA and covers 7,680 acres (12 sections) in the Teton Division of the Bridger-Teton National Forest. NCRA's proposed wellsite (NE¼NW¼ sec. 16, T. 40 N., R. 115 W.) is approximately 6 miles southeast of Jackson, Wyoming, and is adjacent to Cache Creek. NCRA proposed reconstruction of an old road up Cache Creek for access to their wellsite. An alternate route via Game Creek would bypass the town of Jackson and much of Cache Creek. In either case, the proposed drilling activities would still impact the upper end of the watershed. In addition, future drilling could take place within the recommended Gros Ventre Wilderness. The initial wellsite and both access route alternatives lie outside the recommended wilderness boundary.

Bear Thrust Unit exploratory well (Getty).--Reserve Oil, Inc., of Denver submitted an APD for a wildcat well on their Bear Thrust Unit in October 1979. This drilling application is now known as the Getty APD, because Getty Oil Company now controls Reserve Oil, Inc. The Bear Thrust Unit comprises 25 leases and covers 24,900 acres (39 sections) in the Teton Division of the Bridger-Teton National Forest. The northern boundary of the Bear Thrust Unit is contiguous with the southern boundary of the Cache Creek Unit, and the Bear Thrust Unit lies almost wholly within the recommended Gros Ventre Wilderness.

Getty's proposed well (SW¼SW¼ sec. 8, T 39 N., R. 114 W.) is 7 miles southeast of NCRA's Cache Creek well location and is in the Little Granite Creek drainage. Road access to this proposed site and drill pad construction could create significant surface disturbances.

Need for Federal Action

NCRA and Getty propose to explore for oil and gas resources on public lands administered by the U.S. Forest Service. They wish to begin drilling as soon as possible, if and when approval is granted. These initial exploration activities could lead to further exploration drilling within the two units and possibly to field development if oil or natural gas is discovered in commercial quantities.

Summary of the Effects of Implementation: Cache Creek Alternatives

Two drilling access road alternatives, projected field development, and the disapproval (or no action) alternative were studied in depth by the USGS and FS. Under the approval alternative, the USGS-FS also considered the possibility of granting unqualified approval versus a limited approval option that would be limited to the initial APD only. Several other alternatives were also considered but discarded because of their impracticability.

The Cache Creek road access alternative for an initial well is preferred by NCRA because it is the most direct route to their proposed wellsite. This alternative would 1) greatly interfere with recreational users of the Cache Creek Canyon, 2) disrupt local residents of Jackson along portions of the access through town, 3) require repair or upgrading of several city streets, 4) affect the visual esthetics of the lower and middle portions of Cache Creek, and 5) temporarily disrupt wildlife in the Cache Creek watershed for at least 12 to 18 months.

Many recreational activities would be curtailed because of heavy truck traffic: backpacking, hiking, jogging, cross-country skiing, snowmobiling, camping, steak rides, and hunting. Noise levels would be particularly offensive to home-owners along the route and incidents might flare up between local residents and drilling personnel. A stipulation restricting construction activities during elk calving would minimize wildlife impacts the first year when the road and well pad are constructed. Once drilling is underway, it would be impractical to shut down in order to accommodate the animals. This might interfere with elk calving during the second year.

Drilling of an initial exploratory well, using the Game Creek access, would create some of the same impacts as would the Cache Creek route. However, it would avoid residential areas, so noise intrusion and the potential for incidents would be greatly reduced. This route would bypass lower, heavily-used portions of the Cache Creek watershed but would still affect recreation in the middle and upper portions of Cache Creek where current use is moderate to high. Some local residents of Jackson might welcome upgrading of the Game Creek road as it would provide better access for recreation in that watershed. The elk calving area which overlaps the well location would be temporarily disturbed (12 to 18 months) by NCRA's proposed drilling in either case. A stipulation would be added to the APD approval, to minimize the effects on the elk. The fishery in Game Creek could experience increased pressure due to the improved access. Also, a Game Creek road could increase disturbance of wildlife due to the effects of unauthorized use by four-wheel-drive vehicles, trailbikes, and increased number of snowmobiles.

Should field development occur in the Cache Creek watershed it would likely produce high impacts on recreation, wildlife (particularly elk), and local culture for many years (20 years or more). Dust and odors would be generated in the upper end of the Cache Creek watershed from drilling, maintenance vehicles and well heads or tank batteries. These would diminish the esthetics of the watershed. The potential for contamination of surface water would be increased because of multiple well heads, buried pipelines, and frequent use of the roads by maintenance vehicles. A major elk calving area could be eliminated because the area would be intruded by access roads and well heads. The exact effects on the elk cannot be entirely predicted; however, long term disruption of the calving area coupled with habitat reduction could result in a population decline. Visual qualities would be severely compromised in the heavily used area. Noise from development drilling and vehicles, the road system, and landscape disruption would make the area unattractive to many forms of recreation. Many activities would be severely compromised in the middle and upper reaches of Cache Creek. This would particularly affect local residents of Jackson, as they comprise the large majority of the recreational users of Cache Creek.

Summary of the Effects of Implementation: Bear Thrust Alternatives

Two drilling alternatives, projected field development, and a disapproval (no-action) option were evaluated by the USGS and FS. And, as in the case of the Cache Creek APD, several other alternatives were considered but discarded because of their technical or legal impracticability.

The Little Granite Creek road alternative for a single well is preferred by Getty Oil Company. This alternative would create moderate to high impacts on riparian vegetation, fisheries, wildlife, visual esthetics, and wilderness attributes of the Little Granite drainage. Sediment levels might increase in the creek

because of the proximity of the road to the stream. Reclamation of the road would be particularly difficult because of the steep terrain and unstable slopes traversed by this route. Scars would persist for many years along the mile of road directly below the wellsite along Little Granite Creek. Impacts to recreation would be low to moderate due to the remoteness of the area, although the road itself would intrude the recommended Gros Ventre Wilderness. Trucks and other vehicles would slightly disrupt moose habitat in the lower reaches of Little Granite Creek, but the route would avoid any elk calving areas. There would be only a minor incursion to the summer range of big game animals. Most residents of Jackson would never see the site, and contact between drillilng crews and local citizens would be minimal. The drilling rig would be visible over a large area during the ±12 months required to complete the operation. This is the result of the location of the rig on a high, open divide. Camouflage (paint) might mitigate the visual intrusion to some extent.

A helicopter mobilization alternative for an exploratory well was studied by the USGS-FS as an alternative to Getty's conventional road access alternative. This option would result in high noise and visual impacts to the Little Granite area. Helicopter operations would disrupt recreational users and hunters, although their use of the area is low at present. This alternative, as in the case of the Little Granite road alternative, would intrude the recommended wilderness. The sight of helicopters would become virtually continuous in the sky for a period of ±12 months, provided the well could be drilled with no complications. The large campsite, storage area, and drill rig would dominate the landscape during the term of operations. Wildlife might acclimate to the high noise levels because of the routine, corridored flights.

Field development of the Little Granite anticline in the Bear Thrust Unit would produce high impacts on the present wilderness character of the area for 20 to 30 years. (The Wilderness Act of 1964 clearly recognized that this possibility could occur in some areas managed as wilderness and provided for this contingency.) Roading of upland benches along the Gros Ventre Mountain front would create moderate to high visual intrusion; however, this could be mitigated to some extent by rehabilitation. Human impacts to the big game summer range would be moderate on elk populations but high on bighorn sheep. A mitigating factor is the restricted nature of the road access. Motor vehicles and movement of forest users (including those of oil and gas personnel) could be closely managed, as there would be only one road into the high country via Little Granite Creek. A permanent guard could easily control unauthorized use of the road by hunters, recreationists and 4-wheel drive enthusiasts. Moose wintering areas along the lower portions of Little Granite Creek might be disrupted by vehicles and trucks during development drilling and perhaps by maintenance crews.

Contributions to the Nation's Energy Needs

Based on what can be observed at the surface, and on evidence in hand (i.e., geologic mapping and seismic data), the inferred Cache Creek prospect is relatively smaller in size than the Bear Thrust prospect. Neither potential structure is within the Overthrust Belt. Both of these prospects lie in a strip of the Hoback Basin which was compressed between two opposing thrust sheets. Therefore, it is doubtful that drilling would discover stacked structures and very thick pay zones as in the case of typical Overthrust areas near Evanston, Wyoming (see further discussion in chapter II).

Conclusions

Cache Creek Unit.--The USGS-FS analysis in chapter VI of this EIS illustrates that the drilling of one well, using the Game Creek route, fully or partially meets all of the USGS-FS evaluation criteria. At the same time, the two bureaus conclude that development of an oil/gas field in the Cache Creek watershed could produce long term significant adverse impacts on many valued resources. The probability of success for exploratory, wildcat drilling is very low, approximately 5 percent. And the analysis of full field development must be viewed in proper context. The analysis of field development is highly speculative and would remain so until any potential oil and gas resources have been inventoried by drilling.

A limited approval option satisfies many USGS-FS objectives. That is, approval could be limited to the initial APD only, with the understanding that the government might pursue a disapproval option subsequent to the drilling of the first test well. Two additional alternative approaches are to 1) grant unqualified approval to the initial APD, with the understanding that full field development would also be approved, and 2) immediately pursue a disapproval option and attempt to close out all drilling in the Cache Creek Unit by seeking Congressional action. Compensation to NCRA, either in the form of an outright payment or lease exchange would necessarily be involved with any disapproval option, and this would have to be an integral part of any Congressional action.

Several legal aspects analyzed by the U.S. Department of the Interior Regional Solicitor's Office in Denver have a bearing on these matters. The Regional Solicitor advises that an oil and gas lease granted under the Mineral Leasing Act conveys a property interest enforceable against the United States. It cannot be canceled at the whim of the Secretary. It can only be canceled if the lessee breaches one of the terms of the lease or if the lessee agrees to the lease cancellation. Such a lease may, for certain specified reasons, be suspended temporarily by the Secretary so as to prevent any work thereon. In granting such suspensions, however, the Secretary may not rely on facts which are unlikely to change in the reasonably near future. Such a suspension would amount to a cancellation and such a cancellation is not authorized by law. During a temporary suspension, the Secretary can 1) attempt to mitigate development concerns, or 2) initiate Congressional action to cancel the leases.

The statutory and regulatory scheme pursuant to which the leases involved in this EIS were issued does not authorize the Secretary to cancel them for reasons relating to the impact of development upon the environment. The Secretary may only impose reasonable conditons or stipulations designed to prevent unnecessary or undue degradation of the environment. Accordingly, if the Secretary concludes that it is in the public interest not to develop all or part of the leases in question, he must seek authority from Congress to cancel them.

The Secretary clearly has authority to suspend leases while seeking authority to cancel them, and to obtain an appropriation in an amount necessary to compensate the lessees for their leases. It is likely that any such suspension would be of relatively short duration. If Congress failed to act on such a request before adjourning the 2-year session during which it was introduced, it could be concluded, in the absence of extenuating circumstances, the Congress was unwilling to grant the requisite authority and funds.

In the absence of Congressional authority to cancel the leases, the APD's which have been filed in connection with the leases involved in this EIS would be approved within a reasonable period of time subject to reasonable stipulations designed to prevent unnecessary or undue degradation of the environment.

The USGS-FS favor a limited approval approach (i.e., allow NCRA to drill one well and then reevaluate the situation). This type of approach is routinely applied to most oil and gas APD's. However, in the case of Cache Creek, detailed (or as detailed as possible) analysis of projected field development impacts has been performed by the USGS-FS. This additional analysis may have the effect of creating an atmosphere of optimism or pessimism in the minds of the proponents or opponents as to the outcome of the project.

The Game Creek route has many environmental advantages over the Cache Creek route proposed by NCRA. Estimated construction and reclamation costs for the Game Creek access ($935,000) are not significantly greater than costs for the Cache Creek route ($720,000). The difference in cost for constructing and reclaiming the two routes ($215,000) is a small amount of money relative to the total cost of drilling the proposed exploratory well in the Cache Creek Unit (which will amount to several million dollars). The $215,000 difference also does not include unknown costs for upgrading or repair of Jackson city streets, if the Cache Creek route were utilized. The Game Creek route could serve as long-term access to a developing well field; the Cache Creek route could not. A requirement for NCRA to use the Game Creek route over the Cache Creek route therefore seems reasonable to the USGS-FS and is recommended by both bureaus.

Bear Thrust Unit.--Getty's proposed wellsite lies within the recommended Gros Ventre Wilderness, which was recommended to Congress for inclusion into the wilderness system as a result of the RARE II program. The areas encompassed by the proposed wellsite and access road are currently managed as wilderness. The USGS-FS believe that after any oil/gas reserves were depleted (20 to 30 years) the effects of Getty's drilling on wilderness values and visual resources could be reduced with proper rehabilitation. The current undisturbed, remote, roadless character of the area would be altered, but it would affect very few people and generally avoid key wildlife habitat. Proper management of personnel involved with field development would mitigate or minimize most adverse impacts. After extraction of any oil/gas and rehabilitation, the area could again be managed as wilderness.

The Gros Ventre area has been managed as "de facto" wilderness for many years because of its unique scenic and wildlife attributes. Efforts were made to include this area into the Wilderness System after passage of the Wilderness Act of 1964, and prior to RARE I. During RARE I, the area was designated as Chief's Study Area No. 382 for possible inclusion into the Wilderness System. There were minimum conflicts between uses and users within the RARE I area. The FS recommended to the BLM that leases not be issued within this RARE I area until a wilderness decision was reached. The area was again studied under RARE II, and the wilderness boundaries were expanded from that studied under RARE I. Much of the acreage added in RARE II was encumbered by existing Federal oil and gas leases, whereas areas within the RARE I boundary had not been leased and rights conveyed to private companies. The Getty wellsite and the Bear Thrust Unit lie within this acreage added to the recommended Gros Ventre Wilderness as a result of RARE II.

Wilderness designation or recognition of an area has carried with it certain management direction. Every attempt has been made in the case of the recommended Gros Ventre Wilderness to limit surface disturbing impacts. If there is to be continued recognition of wilderness attributes, then there must be continued specialized management. The debate over roads versus no roads lies at the heart of many peoples' wilderness concerns. In addition, the question always arises, "Should a roadless area managed as wilderness be committed to wilderness before the area's mineral potential has been clearly established?"

Two alternatives for Getty's APD request were studied by the USGS-FS because of the wilderness management question: roading via Little Granite Creek and helicopter mobilization for the initial exploration well. The use of a road to accomplish proposed drilling in the Bear Thrust Unit is the conventional approach, and is clearly preferred by Getty. The most significant problems involve construction impacts on Little Granite Creek, reclamation of the road, and road scars which would persist as visual intrusions for many years.

Helicopter mobilization of oil and gas drilling would satisfy the intent of Section 4(d)(3) of the Wilderness Act of 1964 and allow Getty to exercise their drilling rights. It could accomplish exploration and initial inventory of the oil and gas resources with the least surface disturbance or disruption. Disturbed areas could be rehabilitated within a very short time because of the small acreage involved. (Development or extraction of resources is clearly another story, as roads would be required for access, pipelines, etc. The Wilderness Act and FS wilderness allocation process would allow for this contingency.)

Helicopter-assisted drilling is complicated, more expensive, and, as yet, untried in the lower 48 States. The helicopter option may be technically feasible if an onsite ground-water supply could be obtained to sustain drilling and camp operations. The potential financial impact to Getty could be very significant. Costs for drilling the well via helicopter mobilization (provided the onsite water source could be obtained) might range from 15 to 50 percent higher than for convential drilling. This would depend on weather, geologic conditions, and other unknown engineering factors.

The helicopter mobilization alternative fully satisfies practically all of the evaluation criteria. On the other hand, while the road alternative may not fully satisfy as many criteria, it does fully or partially meet all of the USGS-FS objectives. It appears that with proper reclamation using techniques currently available there would be no long-term effects from the Little Granite road other than persistent road scars in the last mile below the wellsite. Reclamation of the road, in the event of a dry hole, would be expensive and involve significant effort, but appears to be something that could be fully accomplished except for the last mile.

The USGS-FS recommend use of the Little Granite Creek road access alternative for Getty's APD request. The technical and cost factors of this option are clearly understood. It is economically feasible and practical, and fully or partially meets all environmental criteria detailed in chapter VI of this EIS.

CHAPTER I

INTRODUCTION

A. BACKGROUND

The USGS and the FS have jointly prepared this draft environmental impact statement (DEIS). It discusses proposed exploration and conceptual development and production of oil and gas from leased Federal lands in the vicinity of Jackson, Wyoming (fig. I-1). National Cooperative Refinery Association (NCRA) of Denver filed an application for permit to drill (APD) an exploration well in the Cache Creek Unit in 1977. (Note: A "Federal oil and gas unit" is comprised of a group of oil and gas leases, which together generally outline a distinct geologic structure with potential for the presence of oil and gas.) This drilling proposal precipitated the Cache Creek environmental impact statement (EIS). The decision to prepare an EIS was made by the Director of the Geological Survey on January 17, 1980. However, an EIS focusing on this single well would not adequately include related activities nearby. Therefore, the scope of the EIS was enlarged to encompass the proposal by Getty Reserve Oil, Inc. (hereafter called "Getty"), to conduct exploratory drilling operations within the Bear Thrust Unit (fig. I-2).

The final environmental impact statement (FEIS) is due in the fall of 1981, and will help determine whether or not and under what conditions exploration, development, and production might be allowed in certain parts of the Bridger-Teton National Forest.

The drilling proposals by NCRA and Getty will be treated as separate approval actions. Any final decisions based on the analysis will be limited to drilling applications within the Cache Creek and Bear Thrust Units. However, it is the intent that this EIS will provide an environmental framework for considering drilling applications within the general study area.

Item 9 of the joint USGS-FS Memorandum of Understanding, executed on April 17, 1980, defines how the final decision(s) will be made. (See appendix A.) It states:

> The USGS and FS mutually agree to execute a decision document concerning pending oil and gas drilling activities addressed in the EIS within 90 days after completion of the final environmental impact statement.

B. SUMMARY OF DRILLING PROPOSALS

NCRA and Getty propose to explore for oil and gas resources on public lands administered by the FS. They wish to begin drilling as soon as possible, if and when approval is granted. These initial exploration activities could lead to further exploration drilling within the two units and possibly to field development if oil or natural gas is discovered in commercial quantities.

Cache Creek Unit exploratory well (NCRA).--NCRA submitted an APD for a wildcat oil and gas exploratory well on their Cache Creek Unit in October 1977. The Cache Creek Unit comprises three leases held by NCRA and covers 7,680 acres (12 sections) in the Teton National Forest (fig. I-2). NCRA's proposed wellsite

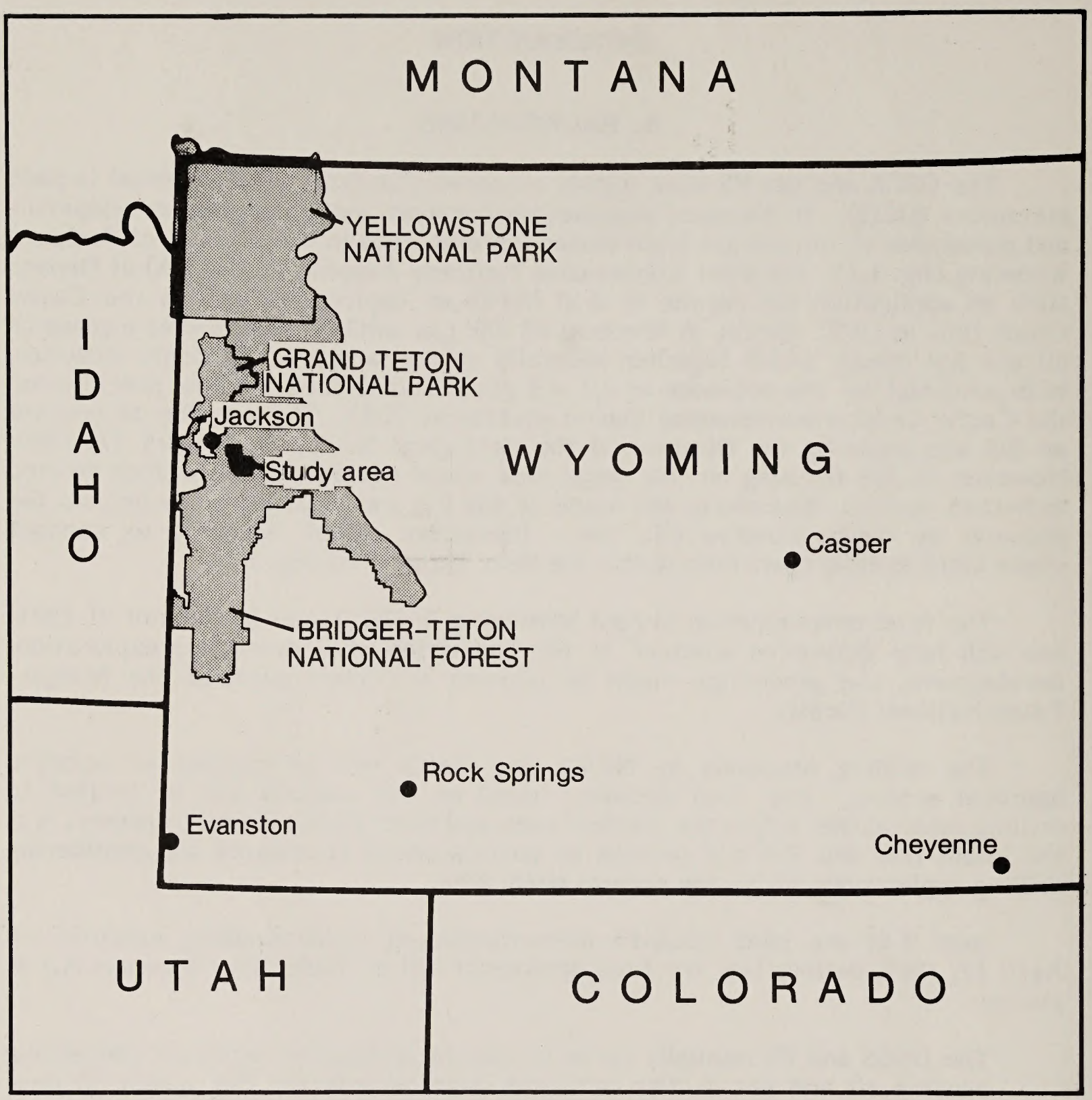

Figure I-1.--General location map.

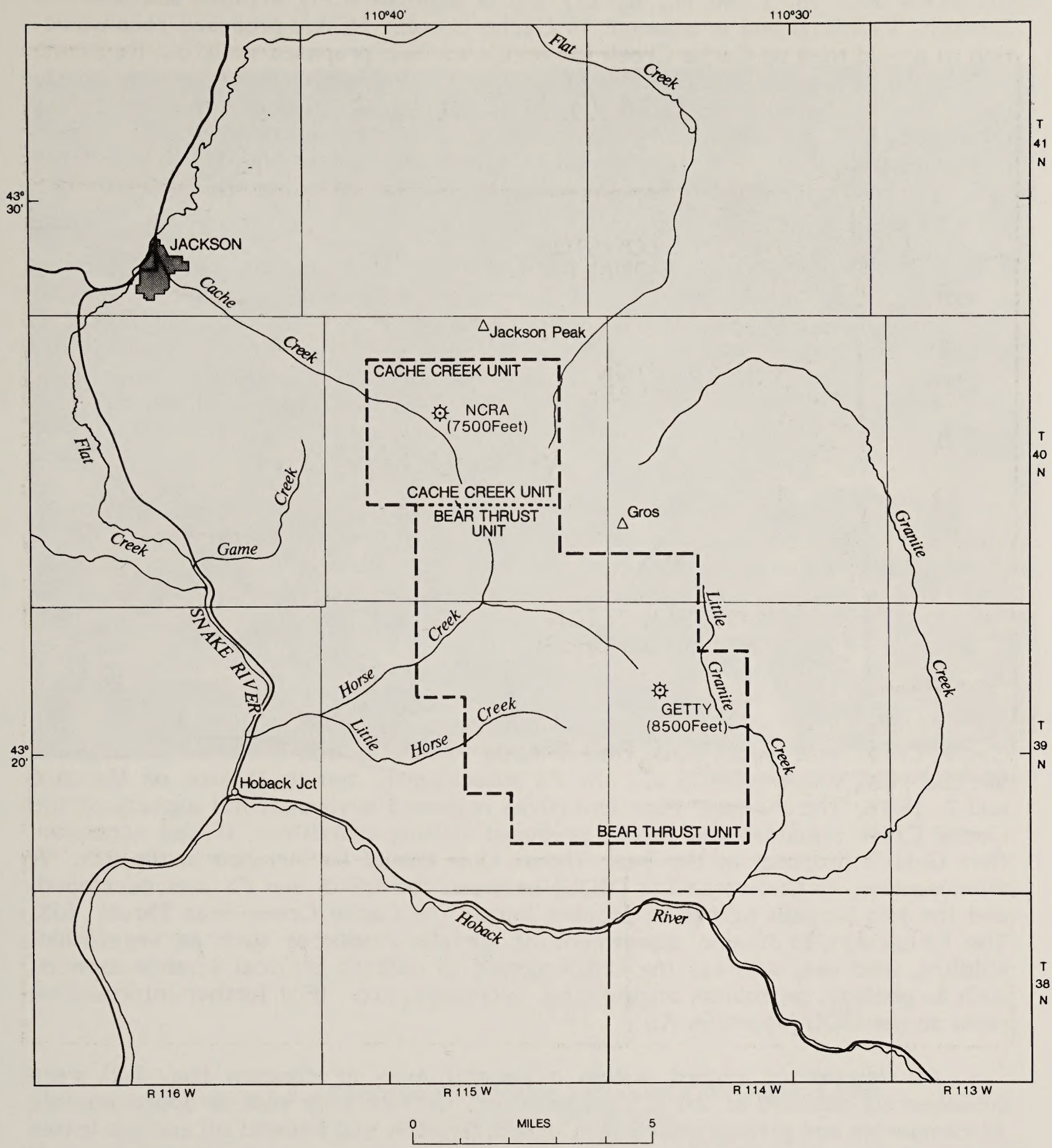

Figure I-2.--Sketch map showing study area.

(NE¼NW¼ sec. 16, T. 40 N., R. 115 W.) is approximately 6 miles southeast of Jackson, Wyoming, and is adjacent to Cache Creek. NCRA proposed reconstruction of an old road up Cache Creek for access to their proposed wellsite. Residents of Jackson informally regard Cache Creek as a "community park" and vigorously oppose NCRA's use of the Cache Creek access (fig. I-3). An alternate route via Game Creek would bypass the town of Jackson and much of Cache Creek. However, the proposed drilling activities would still impact the upper end of the watershed. In addition, future drilling could take place within the recommended Gros Ventre Wilderness.

Bear Thrust Unit exploratory well (Getty).--Reserve Oil, Inc., of Denver submitted an APD for a wildcat oil and gas well on their Bear Thrust Unit in October 1979. This drilling application is now known as the Getty APD, because Getty Oil Company now controls Reserve Oil, Inc. The Bear Thrust Unit comprises 25 leases and covers 24,900 acres (39 sections) in the Teton National Forest (fig. I-2). The northern boundary of the Bear Thrust Unit is contiguous with the southern boundary of the Cache Creek Unit, and the Bear Thrust Unit lies almost wholly within the recommended Gros Ventre Wilderness area.

Getty's proposed well (SW¼SW¼ sec. 8, T. 39 N., R. 114 W.) is 7 miles southeast of NCRA's Cache Creek well location and is in the Little Granite Creek drainage (fig. I-4). Road access to this proposed site and drill pad construction could create significant surface disturbances.

C. Scoping[1]

Following the decision by the Director of the USGS that approval of the Cache Creek well would constitute a major Federal action in the sense of NEPA Section 102(2)(C), the USGS and the FS subsequently met in Jackson on March 6 and 7, 1980. The Bureaus' representatives reviewed environmental aspects of the Cache Creek situation and nearby proposed drilling activities. It was concluded that Getty's proposal in the Bear Thrust Unit should be included in the EIS. A Memorandum of Understanding (MOU) between the USGS and FS was developed, and the two bureaus agreed to prepare jointly the Cache Creek-Bear Thrust EIS. The FS agreed to handle assessment of surface resources such as vegetation, wildlife, land use; whereas the USGS agreed to address physical science aspects, such as geology, petroleum engineering, hydrology, etc. (For further information, refer to the MOU, appendix A.)

All lessees of record within a general area of concern (fig. I-2) were subsequently notified of the EIS preparation. Letters were sent to approximately 35 companies and private individuals. Approximately 100 Federal oil and gas leases had been issued within the general study area, and many were held in joint ownership. These leaseholders were asked to inform the USGS-FS of any near-term exploration and/or development plans. Most leaseholders responded to the inquiry and provided the requested information.

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[1]Scoping is an early and open process for determining the scope of issues to be addressed and for identifying issues related to a proposed action (40 CFR 1501.7).)

Richard Murphy, Jackson Hole News

Figure I-3.--Photograph showing aerial view of Cache Creek from the town of Jackson.

Richard Murphy, Jackson Hole News

Figure I-4.--Photograph showing view of Getty drillsite, looking north. The people in the foreground are sitting on the proposed wellsite. Future drilling within the Bear Thrust Unit would probably occur along the base of the mountain front, on benches and other flatter areas in the background. High peaks of the Gros Ventre Range, visible in this photograph, consist of Precambrian or Paleozoic rocks and have no oil or gas potential.

Concurrently, the FS and the USGS task force leaders prepared a scoping document which summarized the two drilling proposals and the major issues and concerns. Over 300 copies were mailed to various individuals, agencies, etc. The public was asked to respond in writing; orally at the formal scoping sessions, held in Jackson on June 17, 1980, or by calling the USGS collect. The scoping process was further augmented by conducting public hikes to each of the proposed well sites: to NCRA's Cache Creek site on June 16, 1980, and to Getty's site, at the head of Little Granite Creek, on June 18, 1980. Private meetings with company representatives, and environmental groups were also helpful in defining the scope of the EIS. Many governmental agencies and private citizens were briefed on the project. Press releases and personal efforts, particularly by the FS, were used to keep the news media and public informed.

D. IDENTIFICATION OF KEY ISSUES AND CONCERNS

These scoping efforts resulted in a consensus as to the size of the area and critical aspects which should be addressed in the Cache Creek-Bear Thrust EIS. Key issues and concerns were summarized by the USGS-FS at the conclusion of the formal scoping period and forwarded to management for their concurrence. Everyone agreed that the EIS should focus on NCRA's and Getty's drilling proposals in the Cache Creek Unit and Bear Thrust Units, respectively.

Both the Regional Forester, Intermountain Region (Ogden, Utah), and the USGS Conservation Manager, North Central Region (Casper, Wyoming), subsequently approved these "issues, concerns, and opportunities." This was in accordance with a joint FS-USGS decision to adopt FS procedures and EIS format.

Cache Creek issues, concerns, and opportunities

a. Recreation impact (interference with users of Cache Creek drainage area);

b. Esthetics (stigma of Jackson becoming known for oil and gas rather than tourism and recreation);

c. H_2S (hydrogen sulfide gas from drilling operations);

d. Watershed contamination:

   . Seepage from mud pits;

   . Spills of drilling fluids;

   . Sedimentation (associated with runoff from roads, drill pad, and other disturbed areas);

e. Access road(s):

   . Impact on populated areas (trucks in residential neighborhoods);

   . Design of roads on steep slopes, encroachment on stream;

   . Reclamation of the access road and other disturbed areas;

f. Impact on proposed wilderness area (alteration of roadless character);

g. Impact on wildlife (big game/fisheries);

h. Noise;

i. Impact on possible cultural/archeological resources;

j. Geological conditions which indicate potential for oil and gas exploration (desirable to some, undesirable to others);

k. Socioeconomic impacts (pros and cons of community development);

l. National energy needs (contribution of potential oil and gas resources in the Cache Creek Unit);

m. Viability of the NCRA's geologic data;

n. Future conceptual exploration and/or development drilling;

o. Krug Memorandum (appendix B, p. B-1);

p. Exploration under the 1964 Wilderness Act;

q. Liability to the government (public) of nonapproval;

r. Esthetics (visibility of the site to forest users in surrounding terrain).

Bear Thrust issues, concerns, and opportunities

a. Impact on proposed wilderness area (alteration of roadless character);

b. Impact on wildlife (big game/fisheries);

c. Access road(s):

- Design of roads on steep slopes;
- Reclamation;

d. Watershed contamination:

- Seepage;
- Spills;
- Sedimentation;

e. Esthetics (visibility of the site to forest users in surrounding terrain);

f. Impact on possible cultural/archeological resources;

g. Geologic conditions which indicate potential for oil and gas exploration;

h. Socioeconomic impacts (pros and cons of community development);

i. National energy needs (contribution of potential oil and gas resources in the Bear Thrust Unit);

j. Liability to the government (public) of nonapproval;

k. Future conceptual exploration and/or development drilling;

l. Krug Memorandum (appendix B, p. B-1);

m. Exploration under the 1964 Wilderness Act.

E. PERMITS AND LICENSES

The proposed Cache Creek wellsite location is covered by oil and gas lease W-20066 issued by the Bureau of Land Management (BLM) of September 1, 1969. The lease included the following stipulations:

a. Stipulation for Lands under Jurisdiction of the Department of Agriculture (standard resource protection):

b. Jackson Hole Area Oil and Gas Lease Stipulation (requires unitization); and

c. Special Stipulation (requires a plan of construction and development, approved by the FS, prior to any development).

The Cache Creek Unit Agreement maintained these stipulations.

The proposed Bear Thrust wellsite location is covered by oil and gas lease W-20472 issued by the BLM on October 1, 1969. The lease included the following stipulations:

a. Stipulation for Lands under Jurisdiction of the Department of Agriculture (standard resource protection):

b. Jackson Hole Area Oil and Gas Lease Stipulation (requires unitization);

c. Special Stipulation (requires a plan of construction and development, approved by the FS, prior to any development); and

d. Powersite Stipulation (provides for future power transmission needs).

The Bear Thrust Unit Agreement continued with these stipulations and added the following:

a. Special Wildlife Habitat Stipulation; and

b. Department of Energy Stipulation (provided that the lease is subject to the terms and provisions of Section 302 of the DOE Organization Act).

Copies of these stipulations and the Krug Memorandum are included in appendix B. The Krug Memorandum is a Secretarial order which requires lessees to unitize in the Teton National Forest before submitting any drill requests. It also contains additional provisions for environmental protection. Complete copies of the two unit agreements and of leases W-20066 and W-20472 are available for public review at repository locations listed in appendix C.

Both companies would be required to obtain water use permits from the Wyoming State Engineer for their drilling water. NCRA would need to obtain permission from the Jackson Town Council if they were to use the Cache Creek access route; if NCRA were to use the Game Creek alternative, a right-of-way from the State of Wyoming (Game and Fish Department) would be required.

F. BASELINE DATA STUDIES AND OTHER REPORTS

A series of reports was prepared by Government personnel and private consultants to analyze and document various aspects of the Cache Creek-Bear Thrust EIS. The reports cover environmental, engineering, and legal issues. A complete restatement of these reports is beyond the scope of the EIS. This would not comply with instructions from the Council on Environmental Quality (CEQ) to keep EIS's short and to the point. Appendix C contains a listing of the reports by author and title and provides addresses and visiting hours of repository locations where supplementary reports can be reviewed by the public. These reports were used to develop chapters II, V, and VI of this EIS and are hereby incorporated by reference.

CHAPTER II

AFFECTED ENVIRONMENT

A. INTRODUCTION

The affected environment section of this EIS discusses issues and factors most significant to the proposed oil and gas exploration. No attempt has been made to reflect on every environmental component of the Jackson Hole area. Discussion has been geared toward the relevant issues as identified through the scoping process. The reader is referred to the various EIS supplementary reports listed in appendix C for complete discussions of inventory methods and baseline data.

B. PHYSICAL ENVIRONMENT

Topography

The study area is generally mountainous, with elevations ranging from 6,100 feet in the valleys to over 11,000 feet on the drainage divides. The area lies along the southwest edge of the Gros Ventre Range. The Gros Ventre Range forms a dramatic mountain front and is mostly above timberline. Gros Peak, the highest in the study area, is 11,180 feet above sea level.

Major drainage is provided by the Snake River and the Hoback River which joins the Snake at Hoback Junction, Wyoming. Tributaries that drain into the Hoback River are Granite Creek and Little Granite Creek. Tributaries which eventually discharge into the Snake River include Flat Creek, Cache Creek, Game Creek, and Horse Creek.

Geology

The geology of the study area is dominated by three important regional features: the Gros Ventre Range, the Idaho-Wyoming thrust belt, and the Hoback Basin (fig. II-1). The most visible feature is the Gros Ventre Range.

The Gros Ventre Range is an asymmetric, anticlinal uplift which has retained a core of Precambrian crystalline rock. This uplift is characterized by a gently dipping northeast limb interrupted by several asymmetric folds and one major fault. The southwest limb dips steeply and is more complex structurally than the opposite northeast limb.

The Idaho-Wyoming thrust belt, commonly known as the Overthrust Belt, is another major feature in the study area. The thrust belt impinges on the Gros Ventre Range along its southwest margin. It is shown on the cover of this EIS. The belt trends north-south and generally parallels the Utah and Wyoming State border. It trends east-west in the study area and continues into Idaho. The thrust belt influences a large area, as it has been identified in three States. The Idaho-Wyoming thrust belt is a series of large plates of Paleozoic and Mesozoic rocks that have been horizontally displaced from their original area of deposition.

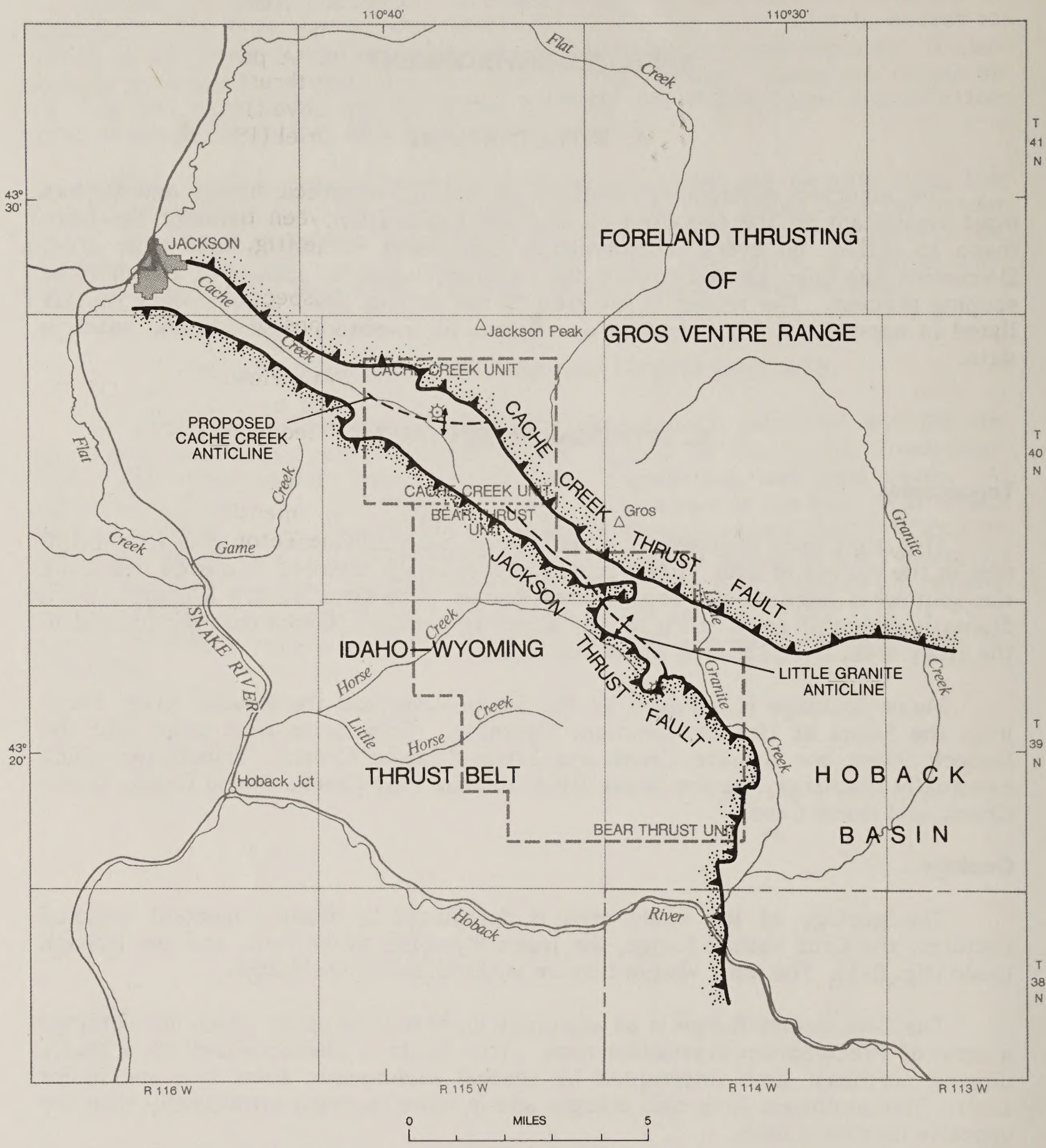


Figure II-1.--Reconnaissance map showing regional geology.

The remaining geologic feature, the Hoback Basin, is located in the southeastern part of the study area. The Hoback Basin is particularly significant because of its location in an impingement zone between the Idaho-Wyoming thrust belt and the foreland thrusting of the Gros Ventre Range. A part of the Hoback Basin, therefore, forms a strip between these two opposing thrust sheets. Detailed accounts of the regional geologic history are presented by Love (1956), Love (1977), Dorr, Spearing, and Steidmann (1977), and Armstrong and Oriel (1965).

The Cache Creek prospect is located in the Cache Creek drainage east of the town of Jackson, Wyoming. The prospect is located between the Idaho-Wyoming thurst belt and the foreland region of the Gros Ventre Range (fig. II-1).

The geologic interpretation of the Cache Creek prospect is regarded as an issue of the EIS. NCRA has studied the geologic conditions of the Cache Creek Unit and has determined that these conditions justify its decision to drill a test well to determine the presence of hydrocarbons in the unit. However, there is an apparent difference between the interpretations presented by USGS Map OF 78-480, authored by J. D. Love, and the interpretations submitted by NCRA.

This normally would not be of great concern, as geologists often have different opinions. However, the Krug Memorandum, mentioned previously, requires unitization as a prerequisite to filing APD's in the Teton National Forest. Unitization is a process whereby a company identifies a geologic structure and then obtains agreements from all lessees with overlying interests to join together for purposes of exploration and extraction of oil or gas present. This results in conservation of the resource, as the oil or gas can be more efficiently extracted, based on geologic conditions rather than purely on lease boundaries. The members of the unit designate one operator, who sets up and conducts exploration, drilling, and development in the area. An additional benefit is that this approach of requiring unitization results in fewer holes drilled, and hence less surface disturbances (no need to test drill every lease). This was one of the basic reasons for invoking the Krug Memorandum procedures in 1947, in the Jackson Hole area.

The USGS must approve all proposed Federal oil and gas units. NCRA's Cache Creek Unit was approved by the Conservation Division of the USGS in 1977, based on geologic data and arguments presented by the company. Some people have asserted that NCRA's data did not support approval of the Unit. The USGS-FS have concluded, after reanalyzing all of the information available, that the Unit is valid, NCRA's interpretation is reasonable, and cannot be proved or disproved except by drilling a test well. This is basically the situation most oil and gas exploration companies face as they evaluate the potential of unknown or unproven geologic structures.

The interpretation submitted by NCRA is based upon the presence of an anticlinal structure (fig. II-2a). This anticline is indicated from surface mapping which shows a repetition of Upper Cretaceous rocks. The anticline is composed of core of Cody Shale surrounded by the younger Bacon Ridge Sandstone. The crestline trends east-west and is truncated on the east by the Cache Creek thrust fault. The eastern exposure of the anticline is covered by Pleistocene glacial deposits. The plunge of the anticline is reported to be toward the west. The rock units roll over on the northeastern flank of the anticline to form a structural trap.

The interpretation of the same area by Love (1978) presents a different evaluation of the rock units in the prospect. Love suggests that the rock sequence

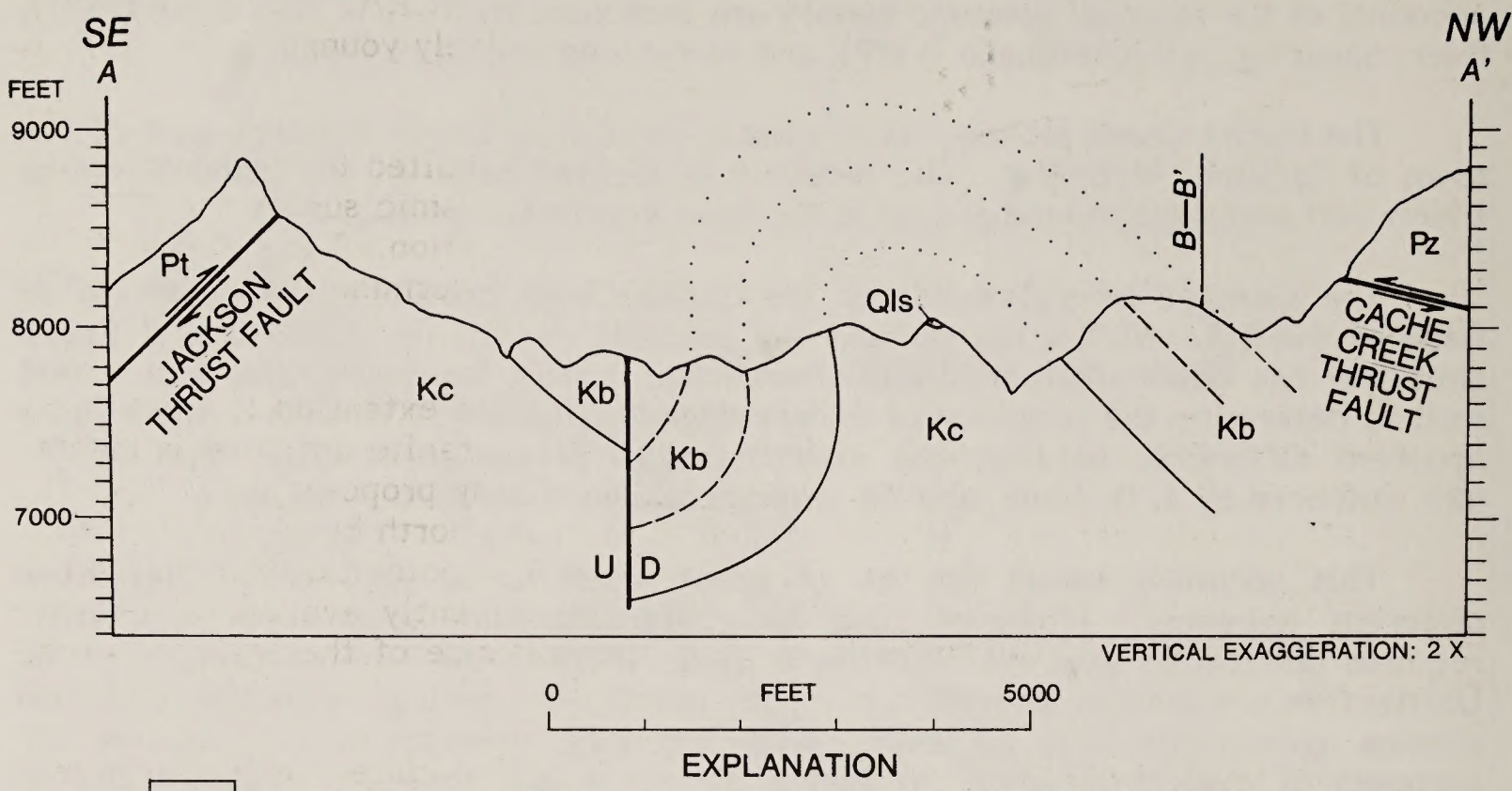


Figure II-2a.--Cross section of Cache Creek Prospect, as interpreted by NCRA.

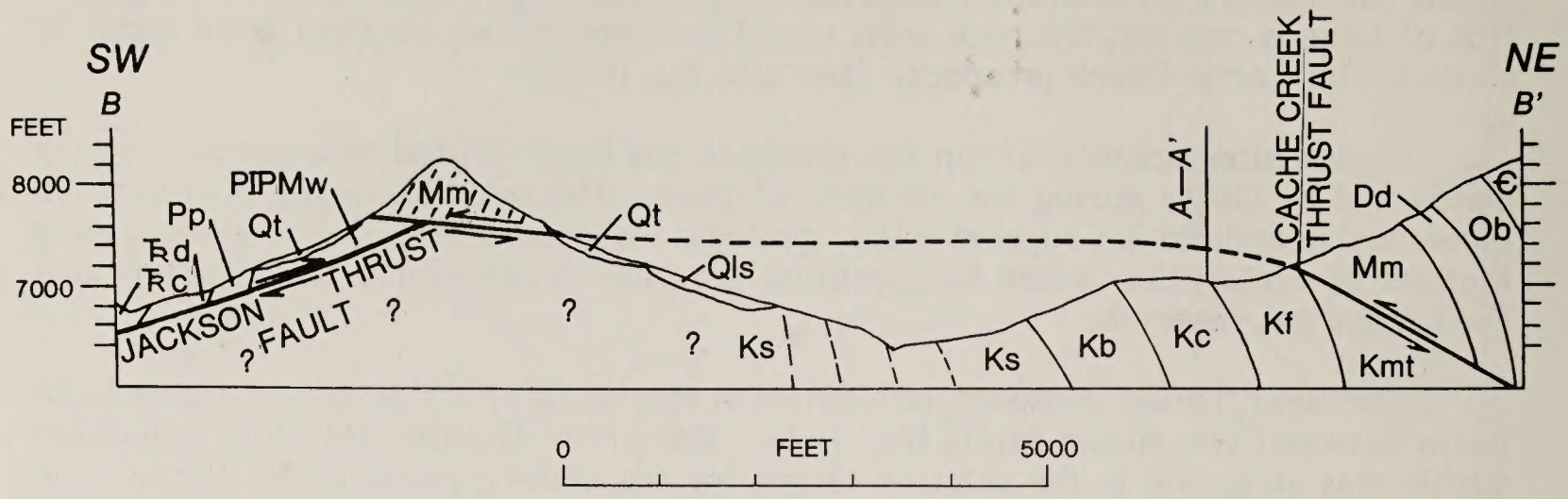
does not repeat itself, as proposed by NCRA, but is continuous through the Upper Cretaceous (fig. II-2b). This means that where NCRA has identified a reoccurrence of the Bacon Ridge Sandstone, Love suggests a continuous sequence with the occurrence of the younger Sohare sequence (formerly an unnamed "lenticular sandstone, and shaley sequence, and coal sequence"). This sequence of rock units would not support an anticlinal structure as proposed by NCRA. If the interpretation of Love is correct, the rock units would be progressively younger from north to south in the Cache Creek prospect. (See also fig. II-2c.)

Exploration activity within the prospect has been limited to a seismic survey conducted by Getty during the summer of 1980. The seismic survey proved to be inconclusive and did not support either geologic interpretation. The only remaining method of exploration would be a drilling program to determine the structure and the oil and gas reserves.

The Bear Thrust prospect is located in the northern extension of the Hoback Basin between two thrust faults (fig. II-1). The Little Granite anticline is located within this strip and is the primary target for the drilling proposed by Getty. The structure is visible on the surface but is truncated to the north by the Cache Creek thrust fault at the base of the Gros Ventre Range. The potential for hydrocarbon accumulation is favorable, based upon information currently available. Reserve Oil's original seismic data tended to confirm the presence of the anticline in the subsurface.

Other exploration in the area has been limited. The closest drilling occurred in sec. 27, T. 39 N., R. 114 W. The well was drilled to a total depth of 4,590 feet and was abandoned as a dry hole. This well was drilled on a separate faulted fold en echelon to the Little Granite anticline. The closest reported show of hydrocarbons is Rainbow Resources Federal 1-35, located in sec. 35, T. 39 N., R. 114 W; the well had an initial production of 725 thousand cubic feet of gas per day and 115 barrels of water per day at a choke setting of 12/64 of an inch from an interval in the Frontier Formation at a depth of 15,952 feet. This well is presently shut-in. Getty conducted seismic exploration in the unit area and in adjacent locations during the summer of 1980. However, Getty's 1980 seismic exploration program did not provide any additional knowledge of subsurface conditions in the area. The data proved impossible to interpret because of rugged topography, thick Pleistocene deposits, and complex geologic structure and were inconclusive. Drilling is the only definitive way to assess the area's oil and gas potential.

The composite geologic map prepared for this EIS revealed that all areas south of the Jackson thrust have potential for oil and gas (since the area involves part of the Overthrust Belt; fig. II-3). This fact has obviously been recognized for some time, but the composite may point it out more clearly. No one has filed for any additional units in these areas or even indicated their intention to do so; however, there is a strong likelihood that this will occur in the future. On the other hand, FS lands immediately north of the Cache Creek thrust--i.e., Gros Ventre Mountain front--have low potential for oil and gas, based on known geologic conditions. Erosion has stripped all potential reservoir rocks, leaving Precambrian granite and Lower Paleozoic strata exposed at the surface. Conditions there are unfavorable for the accumulation of hydrocarbons. Potential reservoir rocks may exist beneath the leading edge of the foreland thrust.



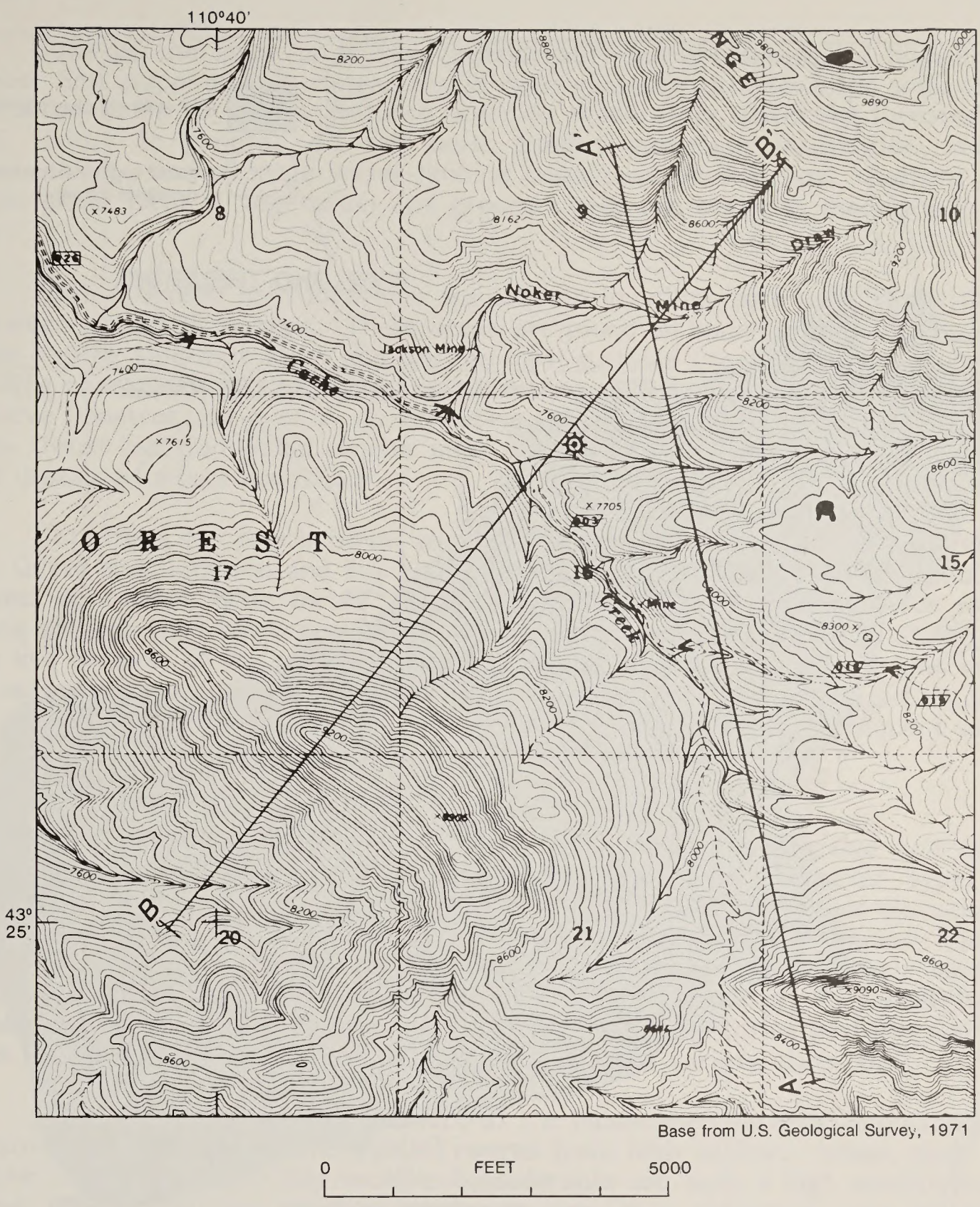
EXPLANATION

Qls	Landslide debris
Qt	Talus
Ks	Sohare sequence (Upper Cretaceous)
Kb	Bacon Ridge Sandstone (Upper Cretaceous)
Kc	Cody Shale (Upper Cretaceous)
Kf	Frontier Formation (Upper Cretaceous)
Kmt	Mowry and Thermopolis Shale, undivided (Lower Cretaceous)
Trc	Chugwater Fromation (Triassic)
Trd	Dinwoody Formation (Lower Triassic)
Pp	Phosphoria Formation (Permian)
PIP Mw	Wells Formation and associated rocks (Permian, Pennsylvanian, and Upper Mississippian)
Mm	Madison Limestone (Upper and Lower Mississippian)
Dd	Darby Formation (Upper and middle Devonian)
Ob	Bighorn Dolomite (Upper Ordovician)
€	Cambrian rocks, undivided

—— CONTACT--Dashed to indicate folding of bed planes within rocks

—— FAULT--Dashed where inferred, arrows indicate direction of movement

Figure II-2b.--Cross section of Cache Creek Prospect, as interpreted by J. D. Love.



Base from U.S. Geological Survey, 1971

Figure II-2c.--Map showing location of cross sections.

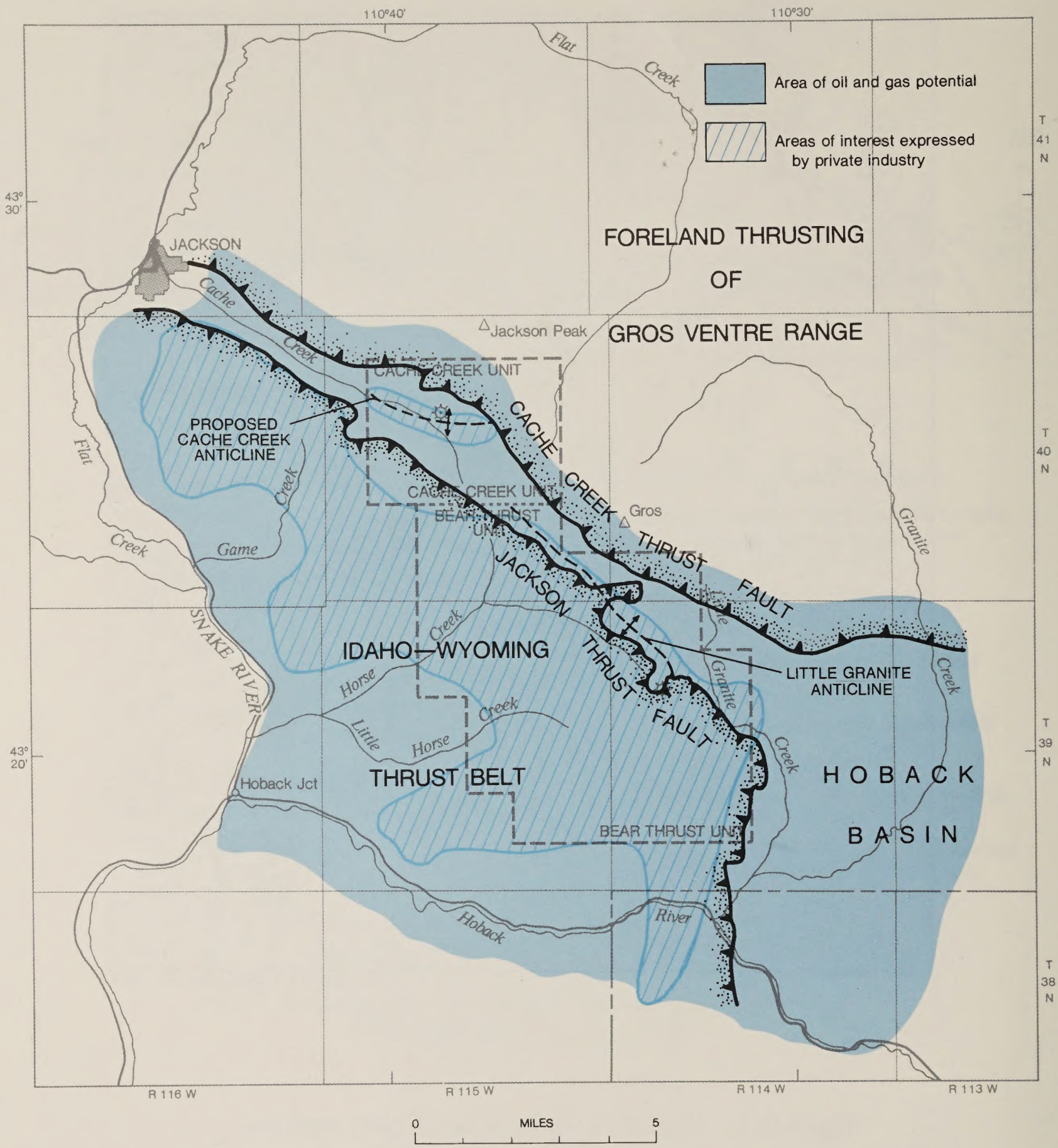


Figure II-3.--Map showing areas of oil and gas potential and industry interest.

Soils

Soils of the lease units vary considerably but are typical of high-elevation areas. Soil mapping units range in type from gravelly loam textured soils of alpine glaciated lands to loamy textured soils on moderately dissected forested slopes (fig. II-4). In general, all soil units exhibit moderate infiltration, moderate permeability, and average water-holding capacities of 4 inches. Current erosion rates under natural vegetation and ground cover are between moderately low to low.

Both proposed drill locations are located in rolling forb meadows with slopes between 10 and 30 percent. These areas are found on benches and ridges along the Gros Ventre Mountain front and are the most suitable for surface occupancy during drilling operations. Road access to either the NCRA or the Getty location would involve construction over a variety of soil types, but potential access to Getty's Bear thrust location would require more stability control because of steeper slopes and unstable surface conditions.

Potentials for debris flows, rockfalls, and landslides appear to be minimal at the Getty drill location and low to moderate at the NCRA wellsite. Road access routes to Getty's Bear thrust location do have moderate potential for rockfalls along several short stretches; however, the potential danger to users of the access are low because of the projected use of the road during exploration. This would be increased with field development. Landslide potential is low. Debris-flow hazards to users are similarly considered to be relatively low due to the infrequent use.

Visual Resources

The visual resources of the area exhibit both a distinctive and common landscape variety within the Central Rocky Mountain character type. The distinctive areas occur mainly at the higher elevations. These upper elevations (for example, the high peaks of the Gros Ventre Range) are rated variety class "A" because of the range of form, line, color, and texture found in their landforms, rock formations, and vegetative patterns. This is based on FS visual resource guidelines. The lower and gentler slopes with fewer vegetative patterns and visible rock formations are typical to the area and are rated variety class "B."

The area's sensitivity (a measure of the landscape's esthetic importance as to location and exposure to the public) ranges from high to low. Areas, such as the Cache Creek drainage, that receive considerable use have a high sensitivity. The Horse Creek drainage receives moderate use, and, therefore, has an average sensitivity. Other areas that receive very little use, such as the upper Little Horse Creek drainage, have a low sensitivity. (Figure II-5 summarizes the visual inventory and illustrates management direction based on visual qualities.)

Climate

The climate within the Bridger-Teton National Forest can be characterized as cold with a moderately humid precipitation regime. There is a variability in microclimate from near-desert to alpine conditions. Winds in the Bridger-Teton area are fairly light year-round.

Due to the generally high elevation and mountain barriers, the study area has a cold climate. Above 7,000 feet elevation, which includes most of the forest type,

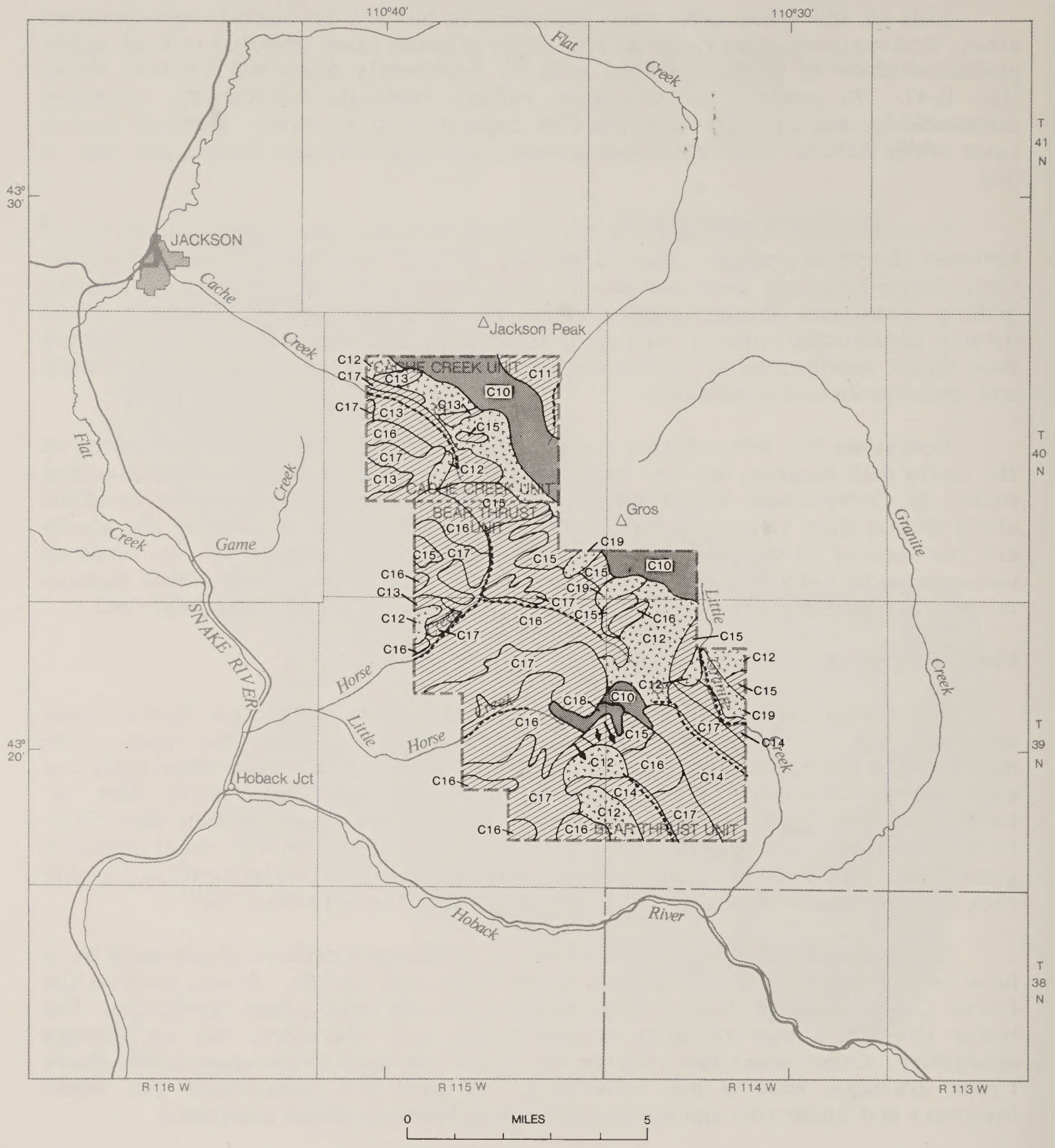


Figure II-4.--Map showing soils inventory.

EXPLANATION

DESCRIPTION OF MAP UNITS

C10 ALPINE GLACIATED LANDS--40 percent to vertical slopes (Lithic Cryorthents, loamy-skeletal, mixed-Rock Outcrop-Typic Cryoborolls, loamy-skeletal, mixed)

C11 GLACIAL TROUGHS--10-70 percent slopes (Lithic Cryumbrepts, loamy-skeletal, mixed)

C12 ROLLING FORB MEADAOW LANDS--10-60 percent slopes (Pachic Cryoborolls, fine-loamy, mixed-Typic Cryoborolls, loamy-skeletal, mixed)

C13 MODERATELY DISSECTED FORESTED SLOPES--20-60 percent slopes (Mollic Cryoboralfs, fine-loamy, mixed-Typic Cryochrepts, loamy-skeletal, mixed)

C14 MODERATELY DISSECTED FORESTED SLOPES WITH SCATTERED LANDSLIDES--20-60 percent slopes (Typic Cryochrepts, loamy-skeletal, mixed-Typic Cryoboralfs, fine, montmorillonitic)

C15 MODERATELY DISSECTED FORB MEADOW LANDS--30-75 percent slopes (Pachic Cryoborolls, fine-loamy, mixed-Lithic Cryorthents, loamy-skeletal, mixed-Typic Cryoborolls, loamy-skeletal, mixed)

C16 STRONGLY DISSECTED FORESTED SLOPES--30-75 percent slopes (Typic Cryochrepts, loamy-skeletal, mixed-Lithic Cryoborolls , loamy-skeletal, mixed- Typic Cryoborolls, coarse-loamy, mixed)

C17 STRONGLY DISSECTED OPEN SLOPES--30-75 percent slopes (Typic Cryoborolls, loamy-skeletal, mixed-Lithic Cryoborolls, loamy-skeletal, mixed-Pachic Cryoborolls, coarse-loamy, mixed)

C18 TALUS SLOPES--40-75 percent slopes (Talus-Typic Cryochrepts, loamy, skeletal over fragmental, mixed)

C19 ROLLING GLACIAL DEPOSITS--10-40 percent slopes (Typic Cryochrepts, loamy-skeletal, mixed-Typic Cryoborolls, loamy-skeletal, mixed)

GULLIES

NARROW RIPARIAN AREAS-- Stream gradient less than 12 percent

ROAD CONSTRUCTION AND RECLAMATION CONDITIONS (Based on soil and slope factors)

Moderate

Difficult

Severe

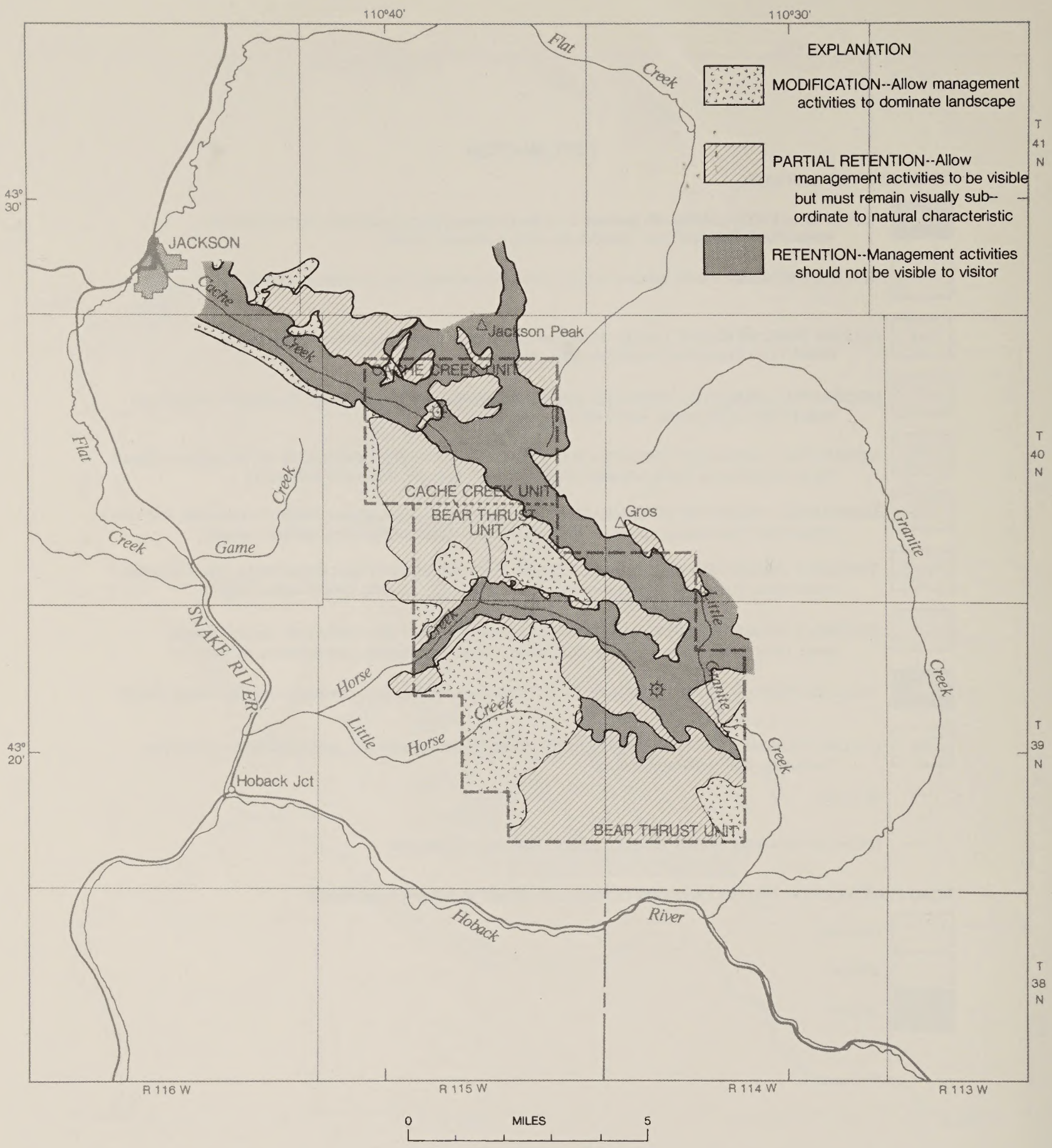


Figure II-5.--Map showing visual classification.

the mean annual temperature is below 32°F. Inversions and downslope flow of cold air are common phenomena. Frost can occur at any time in the summer, and long-term records show that the frost-free period from hard frosts of 28°F is only 2 weeks in late June and early July.

The total annual precipitation varies from a recorded low of 14 inches annual average in Jackson to over 60 inches in the high mountain ranges. Snowfall generally accounts for two-thirds or more of the annual precipitation. The annual distribution of precipitation is reasonably uniform, with a high in December and a low in July. Thunderstorms produce the highest rainfall intensities (which are nonetheless rather low) during which amounts in excess of 2 inches per hour are very rare. Snow depths during the period of maximum accumulation in April range from 3 to 9 feet, and a record snowfall of 40 inches in 1 month has been measured. Blizzard conditions are rare.

Potential for snow avalanches at the proposed drill locations is low. The NCRA site lies on a open ridge above Cache Creek and the Getty site is on a broad, open divide. The highest potentials for avalanches would occur along proposed access routes to the Getty drillsite.

Air Quality

The air quality of the area is excellent with particulate concentrations similar to the environment of the Grand Teton National Park. Further details are available in the baseline air quality report. Air pollution from wood stoves is becoming a problem in the Jackson Hole area during the winter months.

Noise

Background noise levels in the study area are generally very low (15 to 35 dBA); most of the background noise intrusions are associated with recreational uses, wildlife, aircraft, and wind.

Hydrology

Watersheds in the area provide high amounts of surface-water runoff. Surface water originating in the mountains is a calcium carbonate type and is low in dissolved solids. The USGS maintains a comprehensive surface-water gaging station on Cache Creek. Cache Creek has been designated as a "Benchmark Watershed" by the Water Resources Division of the USGS. A comprehensive gaging and monitoring station was installed on the Creek in the 1960's, as part of a National network, to assess long-term water quality changes in watersheds generally unaffected by man's activity. Cache Creek would lose its benchmark status if NCRA's well were approved; however, the USGS would continue the monitoring in order to document and evaluate any changes in water quality. Another benchmark station would be established to replace the Cache Creek facility.

Cache Creek water averages only 170 mg/L dissolved solids. The creek was used in the past as a water supply for Jackson, and the town still retains a 2.5 cubic feet per second water right. This water supply would be unreliable under low-flow conditions as the total flow in the Cache Creek sometimes is less than 2.5 cubic feet per second. The chemical quality of this water is relatively constant throughout the year. Game Creek water is somewhat different in that it contained

higher dissolved solids and sulfate concentrations at the time of reconnaissance sampling by the USGS in September 1980 (fig. II-6). The water in Little Granite Creek was similar in composition to water in Cache Creek at the time of reconnaissance sampling. Peak flow occurs during the early summer months when snowmelt is maximum. The potential for flood damage to roads along these restricted drainages would be high. This would be particularly true of the Getty Little Granite access route. NCRA's proposed wellsite is not located within the 100-year flood plain of Cache Creek; Getty's wellsite is located on a high mountain divide.

The basins represent an immature cycle of the erosion process in their formation and the channels have not achieved a stable grade in their slope profile. Even though stable channel grades have not been achieved, the erosion process is slow. It may be conceived of as following this process: Rubble is produced from the high steep canyon walls and spalls to the talus and colluvial deposits. Due to gravity, these talus and colluvial deposits slowly move toward and encroach the channels. The water, in order to preserve the size of channel needed for its flow rates, then continues to erode the encroaching material along its banks, transports it downstream, and deposits it in the lower reaches of the canyons. Sediment production from overland flow is minimal to nonexistent at the present time.

Ground water in the area is primarily derived from Quaternary alluvium and glacial deposits at lower elevations. These deposits represent saturated alluviums with high permeability. Springs in older rocks such as the Bighorn Dolomite (Ordovician) are found along Granite Creek but do not represent a major source of ground water in the study area.

Geothermal springs have been identified along the southern boundary of the study area. Yield to wells would be highly variable, from 1,700 gpm (gallons per minute) in thick valley alluvium near Jackson to less than 10 gpm in much of the mountainous area. Water wells near Jackson currently supply the town's water needs. Many people have been concerned that spills of drilling fluids would contaminate Cache Creek, which, in turn, because of infiltration, could affect the ground water. Cache Creek recharges the alluvial ground-water system near Jackson, and any long-term water quality changes or contamination could eventually affect the ground water. When Cache Creek was abandoned as a surface-water supply, the old town settling ponds were filled with batteries, car bodies, detergent containers, and some garbage. Apparently no one was aware that contamination of ground water could result from such activities.

C. BIOLOGICAL ENVIRONMENT

Vegetation

The current and potential vegetation of the Cache Creek and Bear Thrust Units is diverse and variable, resulting in different habitat types and community types (fig. II-7). These different types range from warm and dry grass communities, such as Leucopoa kingii-Agropyron spicatum-Festuca idahoensis (spike fescue-bluebunch wheatgrass-Idaho fescue), through mesic forested sites of Abies lasiocarpa/Acer glabrum (subalpine fir/mountain maple) to cold timberline situations (alpine). Current timber types were also mapped according to overstory composition and density. Results of the mapping indicate a high percentage of seral stands throughout both lease units.

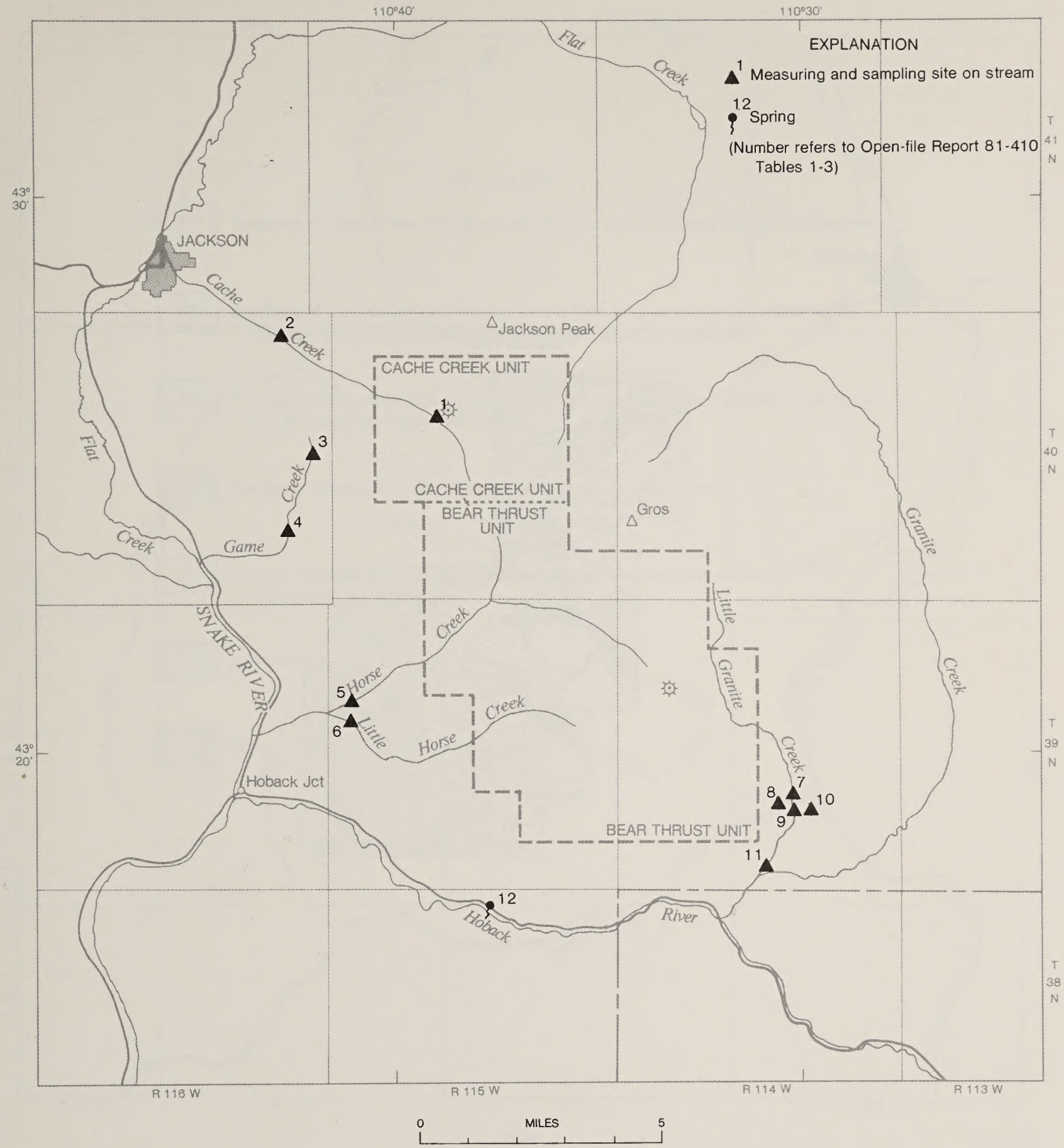


Figure II-6.--Map showing Water Resources Division reconnaissance sampling locations.

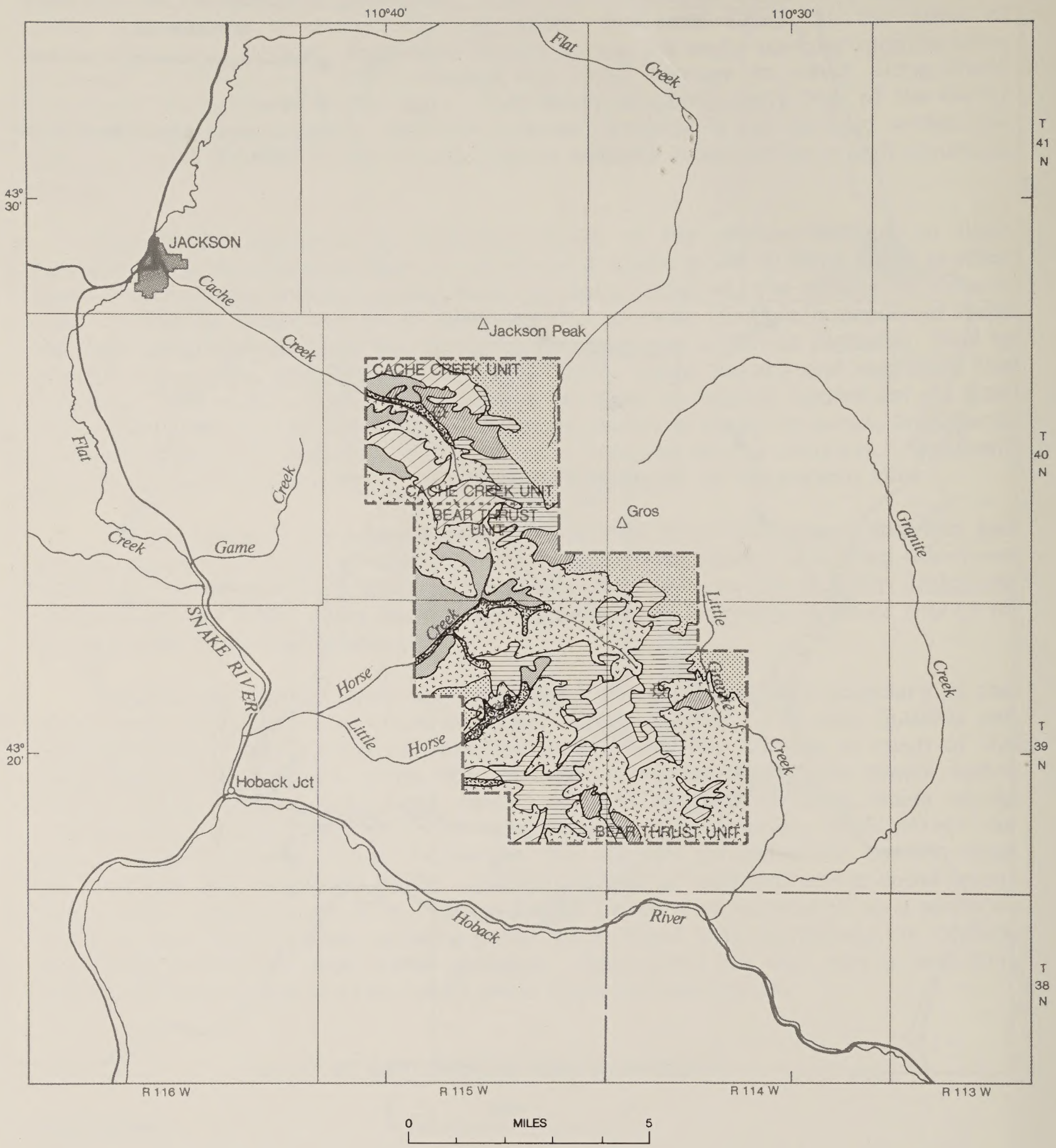
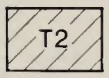


Figure II-7.--Map showing vegetation inventory.

EXPLANATION

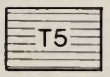
Subalpine fir communities with tall shrubs such as mountain maple and tall huckleberry



Subalpine fir communities with low shrubs and forbs such as grouse whortleberry and mountain arnica; limber pine stands with spike fescue; exposed rock

Timberline communities with subalpine fir and grouse whortleberry; whitebark pine stands; rock and talus; and alpine communities

Douglas-fir communities with pinegrass, spiraea and mountain maple



Tall forb meadows with cow parsnip, ligusticum and single-headed sunflower; alpine sagebrush slopes

Aspen stands

Riparian cooridors with tall forbs and spruce

The NCRA drillsite is on a flat bench supporting a mixture of Populus tremuloides/Ligusticum filicinum (aspen/fernleaf ligusticum) and Populus tremuloides/Heracleum lanatum (aspen/cow parsnip) community types. The variation in types is due to soils with different moisture-holding capacities. It should be noted that Populus tremuloides/Heracleum lanatum (aspen/cow parsnip) communities often occur on recent slumps or areas of potential mass failure.

The Getty drillsite is mapped as supporting a mosaic of Ligusticum filicinum-Delphinium occidentale-Rudbeckia occidentalis (fernleaf ligusticum-duncecap larkspur-western coneflower) and Helianthella uniflora-Agastache urticafolia-Balsamorhiza sagittata (little sunflower-nettleleaf giant hyssop-arrowleaf balsamroot) community types. Tall forbs are dominant.

The variety of vegetation types provides some indication for the potential of revegetation after the initial disturbance. Picea/Galium triflorum (spruce/sweetscented bedstraw), Abies lasiocarpa/Actaea rubra (subalpine fir/baneberry), Populus tremuloides/Heracleum lanatum (aspen/cow parsnip), and Heracleum lanatum-Mertensia ciliata (cow parsnip-mountain bluebells) describe sites of high erosion potential and inherent instability. Sites supporting Arnica latifolia-Aquilegia coerulea (mountain arnica-columbine), Pinus albicaulis/Vaccinium scoparium (whitebark pine/grouse whortleberry), Abies lasiocarpa/Ribes montigenum-Pinus albicaulis (subalpine fir/mountain gooseberry-whitebark pine), Abies lasiocarpa/Vaccinium scoparium-Pinus albicaulis (supalpine fir/grouse whortleberry-whitebark pine), Geum rossii-Leucopoa kingii (golden avens-spike fescue), Artemisia tridentata-spiciformis/Symphoricarpos oreophilus (subalpine big sagebrush-mountain snowberry) present special problems for revegetation because of the harsh climate at these higher elevations.

No populations of threatened or endangered plant species are known to occur within the lease units ("Vegetation Analysis for the Cache Creek EIS," A. P. Youngblood, 1980).

Wildlife

The study area is an integral part of the greater Yellowstone ecosystem, the largest remaining, relatively contiguous, wild country in the conterminous United States. Riparian zones are important for many wildlife species. The area provides habitat for a variety of small mammals. Numerous bird species are present, including the larger raptors. These areas are also important habitat for ruffed jay and other avian fauna. Nongame birds in the area include the Stellars jay, Canadian jay, several species of hawks, and numerous songbirds. The presence of the smaller mammals and birds attract larger terrestrial predators, such as coyotes and bobcats. Large mammals consist of deer, elk, bighorn sheep, and moose. Key winter range and migration routes for each of these populations are in the study area (figs. II-8, and II-9). Key elk calving areas are located along the southwest boundary of the Bear Thrust Unit and within the Cache Creek Unit overlapping the proposed drillsite (fig. II-10).

The broad mountains and remote terrain provide excellent summer habitat for bighorn sheep. In the winter of 1978-79 the Wyoming Game and Fish Department transplanted 13 sheep into the winter range in an effort to increase both the numbers and genetic variation of the Cache Creek herd. Following this release, 51 sheep were counted on the two major wintering areas. These sheep may be expanding their summer range northward. Sheep are commonly observed during

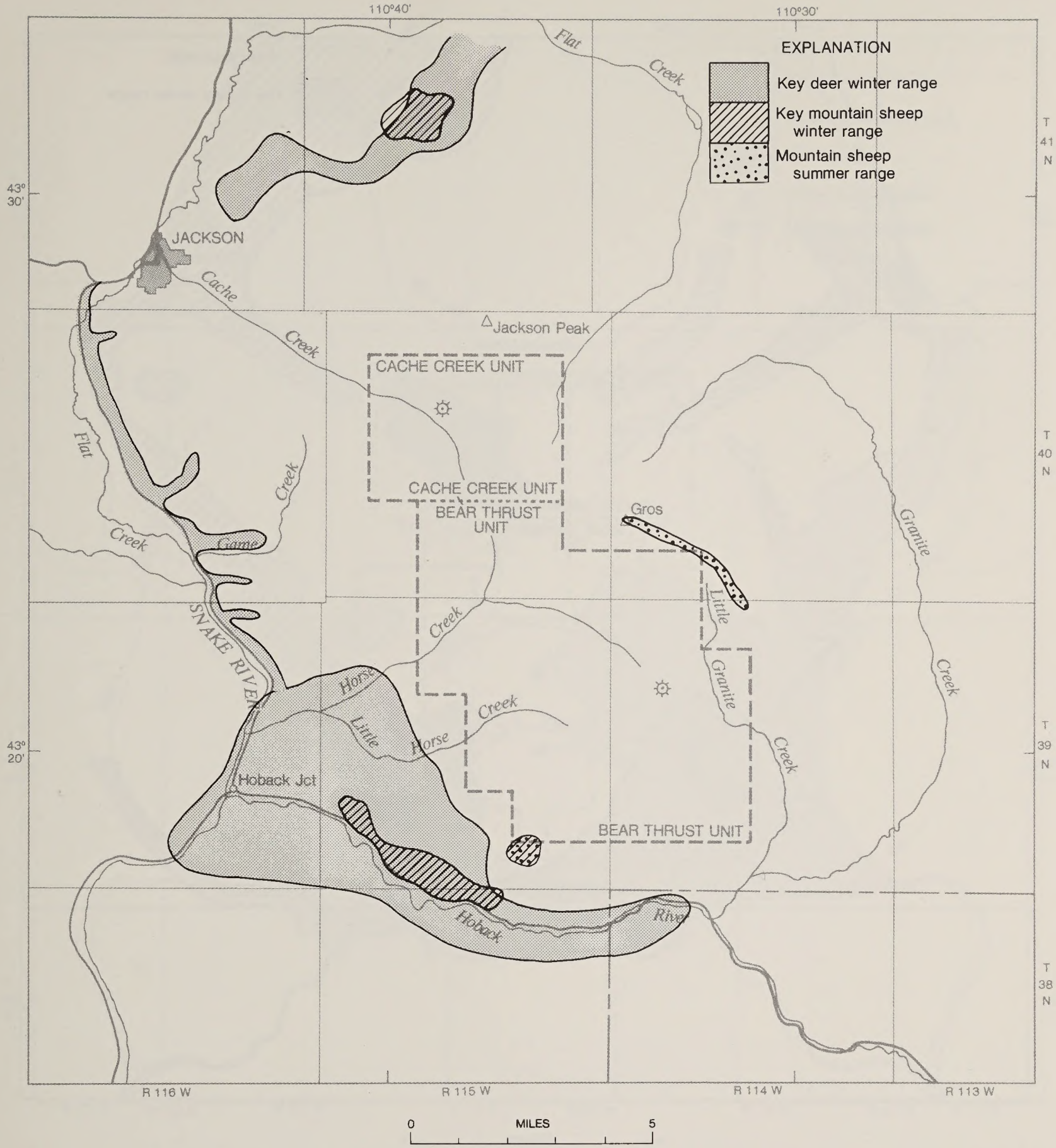


Figure II-8.--Map showing wildlife inventory: Mountain sheep and mule deer range.

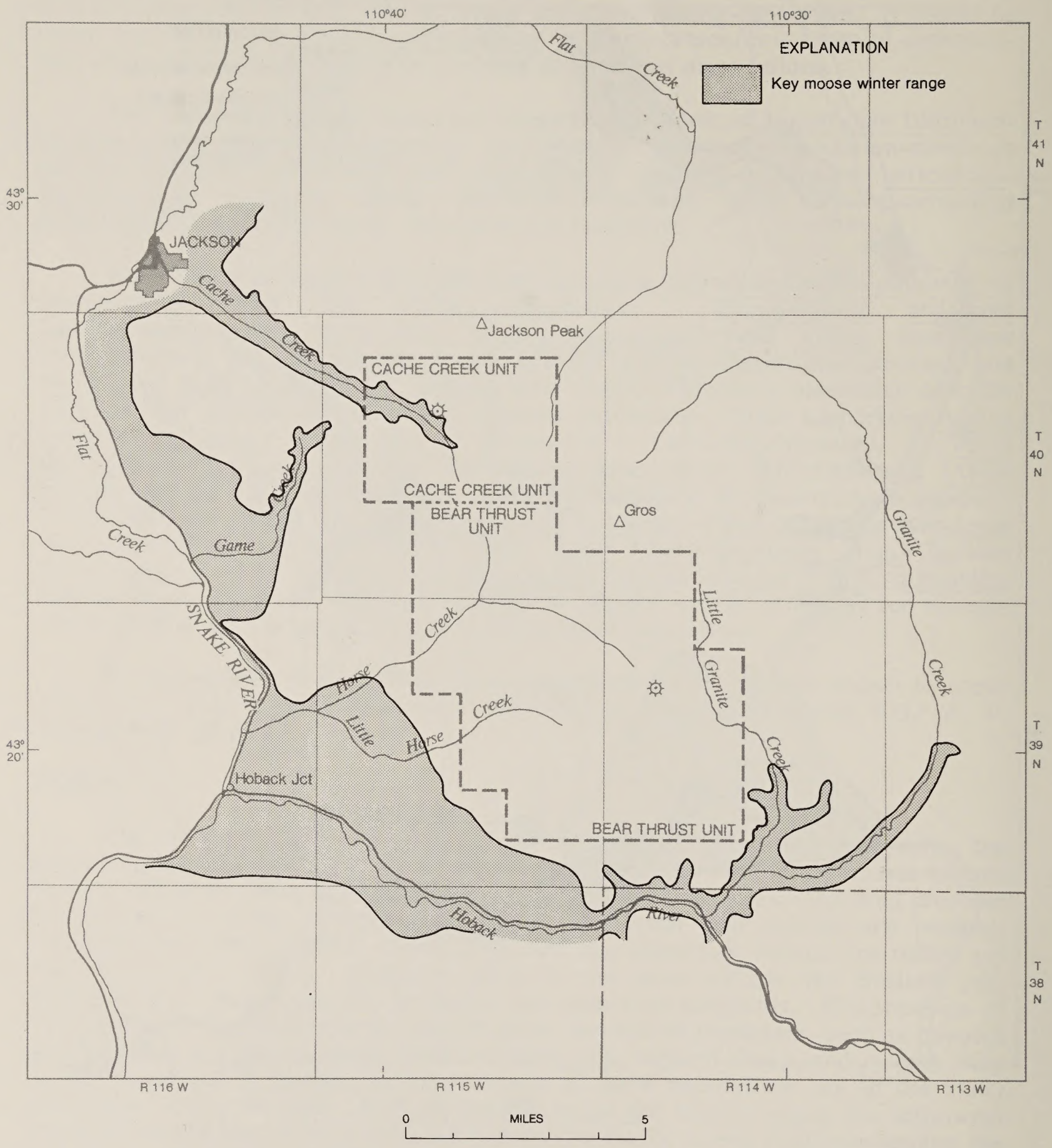


Figure II-9.--Map showing wildlife inventory: Moose winter range.

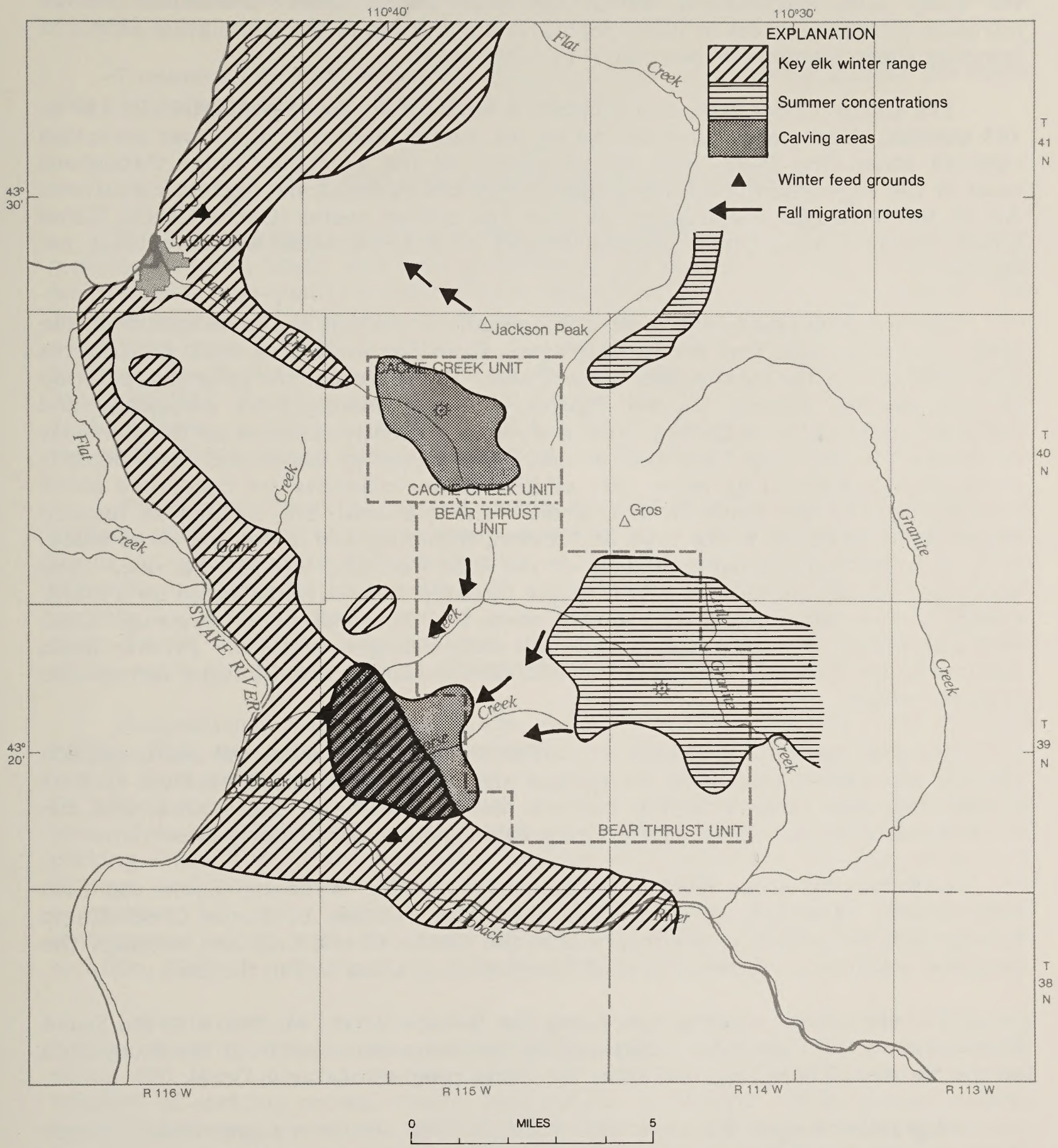


Figure II-10.--Map showing wildlife inventory: Elk range.

the winter along the Hoback River highway in the vicinity of Camp Creek. Important summer range and migration zones for these animals exists throughout the study area, particularly within the Bear Thrust Unit. Persistent human intrusion increases stress in sheep populations and leads to the cumulative effect of lowering sheep numbers or movement to other areas.

The Cache Creek area also supports a substantial moose population of 150 to 165 animals. Moose are restricted during the winter months to the lower elevation riparian zones (fig. II-9). For the remainder of the year they range throughout most of the vegetation types below open ridges and peaks of the highest elevations. All of the drainages investigated as potential access routes (Cache Creek, Game Creek, Horse Creek, Little Granite Creek) have key/crucial winter habitat for moose.

Elk are undoubtedly the most economically important big game species in the area. It is estimated that the harvest of elk from the study area itself contributes over $400,000 to the local economy each year. Elk represent the largest population of any species, largest harvest figures, greatest management emphasis, and greatest economic contribution. The study area presently contains all the elements necessary for year-round survival of elk. The Wyoming Game and Fish Department, several Federal agencies, and wildlife conservationists are concerned about maintaining the elk herds in this area. The National Elk Refuge is located immediately adjacent to the town of Jackson, Wyoming, and is well known to many. It is an important management unit of the U.S. Fish and Wildlife Service. Any disruption of the elk habitat which might threaten their vitality would be a major concern. The refuge provides a winter home for thousands of elk (average 8,300 animals) which spend the summer in the surrounding mountains. Private lands donated to the Federal Government in 1927 by the Izaak Walton League formed the original refuge.

Summer range for 1,250 elk lies within the two lease units. An additional 600 elk are distributed elsewhere throughout the area. The upper reaches of Flat Creek, the open country in the eastern half of the Getty lease area, and the headwaters of Big and Little Horse Creek drainages are particularly important.

Two calving areas have been identified by the Wyoming Game and Fish Department. The first area is along the lower reaches of Horse Creek-Camp Creek, and the second is entirely within the Cache Creek Unit and overlaps the proposed wellsite as well as potential future drilling areas within the unit.

Key elk winter range occurs along the Hoback River, westward to the Snake River, and north to Jackson. Additional winter range exists north of the study area on the National Elk Refuge and along the lower reaches of Cache Creek.

Migration routes between the summer and winter ranges follow major drainage patterns and topographic features. One major route crosses the proposed road access and impact area leading to the Getty drillsite. The Horse Creek-Little Horse Creek area is particularly important.

Fisheries

Aquatic wildlife consists of the native Snake River cutthroat trout and the non-native brook trout. Excellent populations of cutthroat trout are limited to Horse Creek and Little Granite Creek. Brook trout were inventoried in Game

Creek as part of this EIS investigation. The brook trout are regularly stocked by the Wyoming Game and Fish Department. Cache Creek is not a highly productive fishery but is important to local recreational users, particularly local school-age children.

Threatened or endangered animal species do not presently inhabit the study area according to the U.S. Fish and Wildlife Service.

D. LAND USE AND RELATED RESOURCES

Outdoor recreation dominates the area around Jackson, Wyoming. Management by Federal, State, and local government and private conservation groups has maintained a high-quality experience for millions of tourists for many years. The Jackson Hole valley was once noted for ranching; however, ranching income now constitutes only a small fraction of the area's total economy. Ranches have become important for the open country they provide. This, in turn, contributes to Jackson's "Old West" image. National Forest and National Park lands surround Jackson Hole. In addition, the National Elk Refuge borders the town of Jackson to the north. Undeveloped Federal lands comprise 97 percent of Teton County.

The Cache Creek watershed dominates the eastern edge of Jackson and offers a wide variety of recreational opportunities. The Cache Creek watershed forms an extension to the community of Jackson and has more or less been officially managed for local recreation since 1969. Prior to World War II, timber harvest and a small coal operation took place in the watershed. The effects of these former operations are localized, although several miles of graded, graveled access roads remain as evidence of these former activities.

Recreational use of Cache Creek has increased dramatically since the late 1960's. This use increased to the point that environmental damage was occurring, mainly from uncontrolled season-long camping and off-road vehicles. In 1976 the FS closed the upper 2.5 to 3 miles of road to vehicular travel and upgraded the lower 3 miles. The lower portion ends at a gate closure and includes a small parking area. The FS also adopted a "day-use only" policy for the area because of damage and complaints. These actions greatly improved the quality of the experience for many users. Cache Creek offers an unusually fine outdoor environment along with the opportunity for solitude. This, coupled with its location, make it very important to local residents of Jackson.

Summer and fall recreational activities in Cache Creek include jogging, hiking, camping, steak rides, fishing, hunting, and backpacking. Cross-country skiing and snowmobiling are popular in the winter. Springtime use is limited because of melting snows, runoff, and muddy conditions. (This factor reduces human interference with elk calving, which takes place during the spring season.) Local school children have used Cache Creek for scientific studies as well. Approximately 16,000 recreation visitor days (RVD's) are attributed to the combined Cache Creek-Game Creek area, the large majority of which accrue to residents of Jackson (FS Recreational Inventory Management System, 1980 statistics). Recreational use increased rapidly through the 1970's. It appears that additional management will be required in the future to prevent overuse and conflict. Figure II-11 summarizes the user inventory conducted for this EIS.

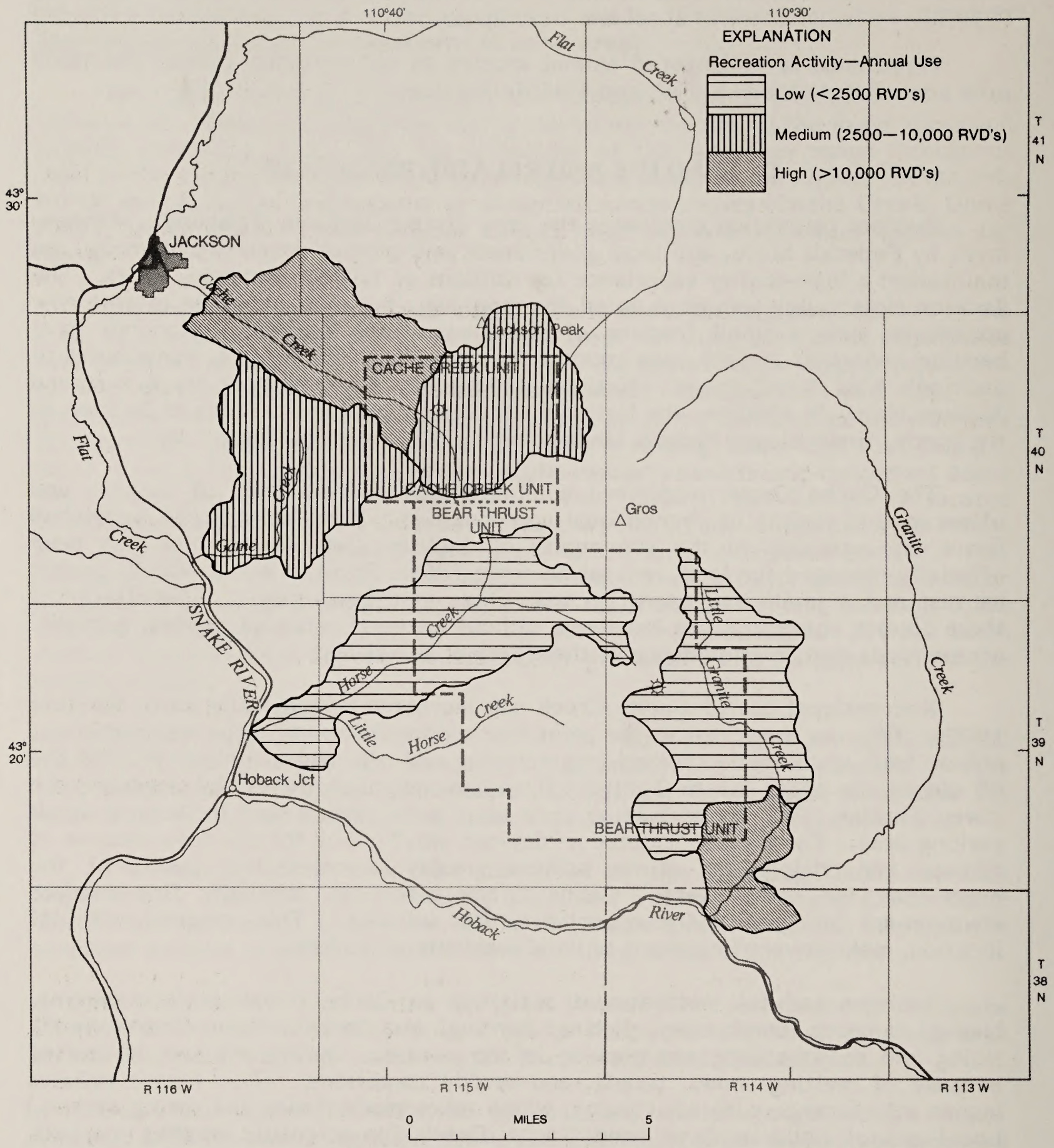


Figure II-11.--Map showing recreational users activity.

Land use in the vicinity of the Getty site is also recreation. There are several small placer claims for gold near the confluence of Rough Hollow and Little Granite Creeks. Coal mining occurred at the end of the existing Little Granite Creek road, but all mining operations have been abandoned. Rugged topography and inaccessibility have restricted the recreation (hunting and packing) to low usage.

Cultural Resources

Two prehistoric sites may be affected by proposed road building and drilling activities. Both sites are recommended for additional evaluation to determine their cultural significance. Site 48TE959 is located along the Game Creek road, and site 48TE956 is located adjacent to the Getty drilling site. Based on surface evidence, both appear to be small, limited activity sites with little potential for scientific research. No other significant cultural values would be affected by the proposed undertaking.

The following actions must be accomplished prior to any final action on the two drill requests:

1. Spot-checks to assess archeological survey adequacy.

2. Site testing, 48TE959 and 48TE956, under FS permit, paid for by companies.

3. Determination of significance and effect, in consultation with the SHPO.

If either site is determined significant and unavoidable:

4. Formal determination of eligibility by the National Register of Historic Places.

5. Develop a salvage-mitigation plan, in consultation with the SHPO and the Advisory Council.

6. Salvage sites (remove scientific values archeologically).

Wilderness

Approximately two-thirds of the study area is within the recommended Gros Ventre Wilderness (Roadless Area 04102W) as defined in the final environmental statement for Roadless Area Review and Evaluation Number Two (RARE II; FS, 1979). The recommended wilderness as described by RARE II was presented to the U.S. Congress for inclusion into the National Wilderness System. The area recommended for wilderness under RARE II expanded the wilderness boundaries from that studied under RARE I. Much of the acreage added in RARE II was encumbered by existing Federal oil and gas leases. The RARE II additions clearly included FS lands with oil and gas potential--the RARE I boundary did not (fig. II-12). The Getty site falls within this added acreage.

This recommended wilderness (289,540 acres) is considered by most environmental and conservation interests to be the largest, unofficially designated wilderness area in the conterminous United States. Excellent opportunities for unstructured recreation exist in the area. The present lack of physical impacts of

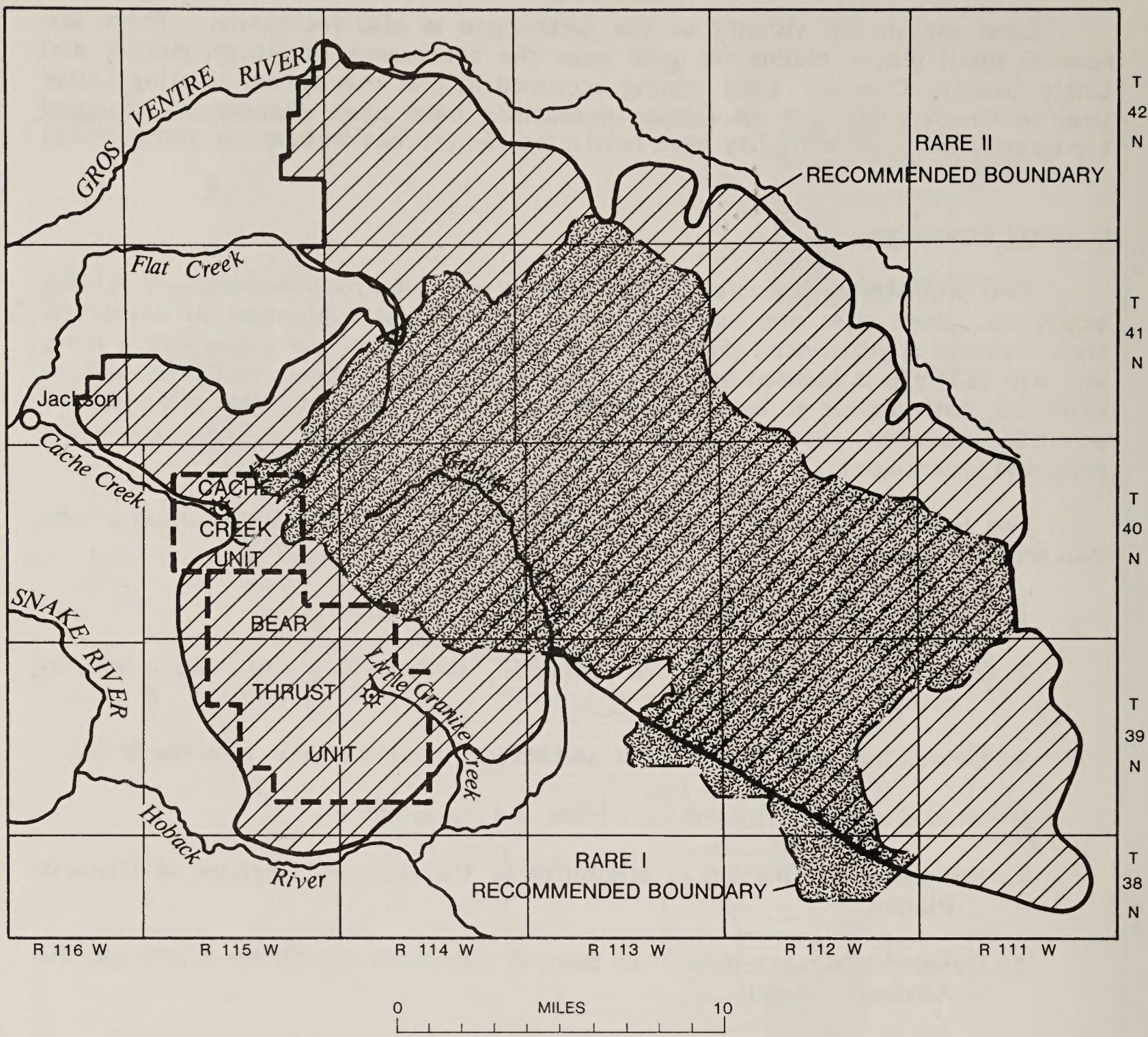


Figure II-12.--Map showing Gros Ventre RARE I and RARE II recommended boundaries.

man has left this area void of any significant degradation. The area offers solitude and viewing of scenic vistas with a variety of terrain from high alpine peaks to subalpine meadow lands. Large mammals (elk, moose, big horn sheep) are often seen throughout the area. These attributes are coupled with the potential for good access and an adequate trail system.

The proposed NCRA Cache Creek site is outside the recommended wilderness boundary by approximately one-quarter of a mile. Both potential access routes (Cache Creek and Game Creek) are also outside the boundary recommended during RARE II. However, additional drilling in the Cache Creek Unit could occur within the wilderness area. The proposed Getty Little Granite site is well within the boundaries of the recommended Gros Ventre Wilderness. Additional drilling in the Bear Thrust Unit would also be well within the wilderness boundary.

Manmade structures or improvements, trails, etc., are limited. The major features include cross-country and snowmobile trails which exist primarily within the Cache Creek and Little Granite Creek drainages. "The Cache Creek Trail is a particular favorite with the Jackson townspeople because it's right out their back door, and easy to travel. Many of the locals take their familites up this in the afternoon, traveling anywhere from 1 to 7 miles up the trail, and then cross over the creek, and back down the old FS road" (Jackson Hole Winter Visitor's Guide, 1981). Outfitter camps oriented toward big game hunting are situated throughout the study area. The Horse Creek drainage is particularly important in this regard. There are no FS administered recreation facilities or designated campsites.

E. SOCIAL AND ECONOMIC FACTORS

Teton County encompasses all of the Jackson Hole Valley, Grand Teton National Park, and portions of the Bridger-Teton, Targhee, and Shoshone National Forests. The population is largely settled in the town of Jackson and the strips between the town and the unincorporated towns of Wilson and Teton Village.

The 1980 U.S. Census describes the population of Teton County as 9,355 individuals. The county grew from 4,823 residents in 1970 to the present figure at a 6.8 annual growth rate over the past decade for a 94.0 percent total growth.

The State of Wyoming is experiencing rapid population growth related directly to the development of energy resources. Current trends indicated a population increase of 42 percent by 1990. The population of Teton County is forecasted to increase by 117 percent in the same period. This growth will not be primarily related to energy development but to increased tourism and natural migration to the area.

The county area is noted for its outdoor-oriented recreational activity coupled with an "Old West" atmosphere. Along with outdoor recreational opportunities, the area offers a variety of entertainment which frequently attracts meetings of private industry and government agencies.

The Hollywood movie industry has recently become interested in the Jackson Hole area because of its attributes. The Jackson Hole Area Chamber of Commerce estimates that crews from "The Mountain Men" spent over $2 million locally. Jackson's Western image, spectacular scenery (essentially uncluttered and protected in Federal preserves), and wide variety of terrain are cited as important

attributes. The movie "Any Which Way You Can" was partially filmed in Jackson also.

Tourism is the major year-round industry and over $50 million was spent locally in 1980. More than 80 percent of this amount is attributed to non-residents. Estimates for non-resident tourist visitations range annually between 3 and 4 million people. They visit the area because of the specutacular scenery and varied ourdoor recreation activities.

The effects of a rapid increase in demand, high construction costs, and high-priced land have produced a serious shortage of "low-priced" housing in Teton County and the town of Jackson. New homes, whether for rent or for sale, are priced beyond the range of many new residents. If a major oil/gas field were to be developed in the Jackson area, availability of suitable housing could also be a problem.

Present services and facilities appear to satisfy the requirements of the community. Teton County must face the problem of generating $40 million through 1990 to provide the required capital facilities and meet an 8 percent annual growth rate.

The socioeconomic report prepared for the USGS-FS contains many more statistics on the community of Jackson than are detailed in this EIS. NCRA's proposed Cache Creek drilling is recognized as one of the major concerns of the local citizenry. The socioeconomic research team concluded that a majority of the business community and a fairly large majority of the total community (60 to 80 percent) oppose drilling in Cache Creek for a variety of reasons. Local opposition to Getty's APD in Little Granite Creek is less.

CHAPTER III

EVALUATION CRITERIA

The evaluation criteria presented in this section summarizes the factors which the USGS and the FS feel are most important. They reflect concerns of groups and individuals that have shown interest in the proposed wells and include environmental, legal and technical considerations. Alternative courses of action will be compared on the basis of how well they satisfy these criteria.

The criteria are:

- Determine the area's potential to contribute to the Nation's energy needs (i.e., inventory oil and gas potential by drilling).

- Recognize the lease rights of NCRA, Getty, and other members of the Bear Thrust Unit.

- Provide for visual quality objectives of the area as defined in the Cache Creek-Bear Thrust mapping evaluation.

- Protect water quality, aquatic habitat, and riparian zones, both onsite and in access corridors.

- Minimize adverse effects on wildlife, basically by recognizing diverse habitat needs and protecting big-game populations.

- Maintain traditional recreational use of Cache Creek drainage.

- Minimize man's intrusion into the recommended Gros Ventre Wilderness in the exercise of mineral exploration and development activities.

- Feasibility of reclaiming disturbed areas to natural conditions at the cessation of activities.

- Minimize impacts on the community of Jackson (overload of community facilities, noise, hydrogen sulfide, and other safety factors).

The USGS and FS also believe that alternatives must be practical, economically feasible, and provide a balance with respect to environmental protection and exploration.

CHAPTER IV

ALTERNATIVES CONSIDERED

The Alternatives considered in this EIS were developed through a comprehensive interdisciplinary technical review and analysis. They incorporate legal restraints and objectives of the two applicants (NCRA and Getty), as well as those of the USGS, USFS, and other agencies involved with the drill requests. In addition, other alternatives considered but discarded because of their impracticability are briefly discussed.

Cache Creek Unit:

1. Drilling via Cache Creek road access.

2. Drilling via Game Creek road access.

3. Disapproval (no-action alternative).

Bear Thrust Unit:

1. Drilling via Little Granite Creek road access.

2. Helicopter mobilization alternative.

3. Disapproval (no-action alternative).

None of the alternatives involve moving the drilling locations. At the Cache Creek wellsite, it would not be possible to move drilling out of the watershed, or move it away from the current staked location, and still satisfy exploration objectives of NCRA. Relocation of the drillsite would not alter any of the basic environmental considerations. The Getty site at the head of Little Granite Creek is also at the most favorable location for testing oil and gas potential of the Little Granite anticline. Other possible sites in the Bear Thrust Unit and still on the anticlinal structure would have to be located in the higher elevations, have similar environmental consequences, and involve the same road access.

A. CACHE CREEK UNIT

The proposed action by NCRA is to drill one test well. They have not specifically indicated any further plans beyond the drilling of one well. However, the company would clearly intend to develop any oil/gas field they might find if economic conditions show that such development is feasible.

Under the approval alternative for NCRA's initial APD, there appear to be two possible procedural options: unqualified approval versus limited approval. Unqualified approval implies full approval for a single well and implied approval for subsequent field development drilling. Under the limited approval alternative, the Secretary would approve drilling of the proposed well only. Data from that well would make it possible to more accurately predict the impacts of field develop ment and consider the environmental and economic tradeoffs. The text focuses on

the impacts of this alternative, although it considers the speculative impacts of full-field development as well. (These same considerations obviously apply to the Getty APD for similar reasons.)

Drilling activities for the initial Cache Creek well would be the same for either of the road access options discussed in this EIS. That is, the type of rig, pad size, drilling schedule, supplies, movement of personnel, etc., would be identical. With either alternative, the rig crews would stay in Jackson and commute to the drilling operation. There would be no onsite camp.

A summary of proposed drilling follows. It is based on NCRA's original APD, supplementary correspondence, and narrative statements from the Cache Creek Environmental Assessment (USGS, 1979). NCRA proposed to drill their initial exploratory well in the Cache Creek Unit by using the Cache Creek road access alternative. It is not NCRA's position that the Cache Creek road should be denied and that the Game Creek road should be allowed. NCRA has stated that if the use of the Game Creek road is necessary to prevent special impacts on Jackson, Wyoming, then the Game Creek road access should be allowed in order to permit the well to be drilled (fig. IV-1).

Proposed Onsite Drilling Activities

Using either Cache Creek or Game Creek road access alternatives, NCRA proposes to drill an exploratory well to the Madison Formation with a total depth of 10,100 feet. The well would test four potential hydrocarbon-bearing zones. The zones in a normal section with no faults or other complications are assumed to have the following depths:

Formation	Anticipated depth (feet)
Frontier	2,730
Phosphoria	8,937
Tensleep	9,210
Madison	10,100

The estimate of drilling depth is based on the surface section measured on the Gros Ventre River as presented by Love and others (1951). Some allowance on the depth has been made for the possibility of steeply dipping beds.

The drilling prospect itself is based on surface geologic mapping done for NCRA by W. Lyle Dockery, consulting geologist, in 1969. Dockery's interpretation of the geology of the Cache Creek area identifies the Cody Shale at the surface of the proposed site, surrounded by the younger Bacon Ridge Sandstone. This interpretation indicates the presence of an anticlinal structure. (See the Affected Environment section of this EIS for a more complete discussion of the geology of the Cache Creek prospect.)

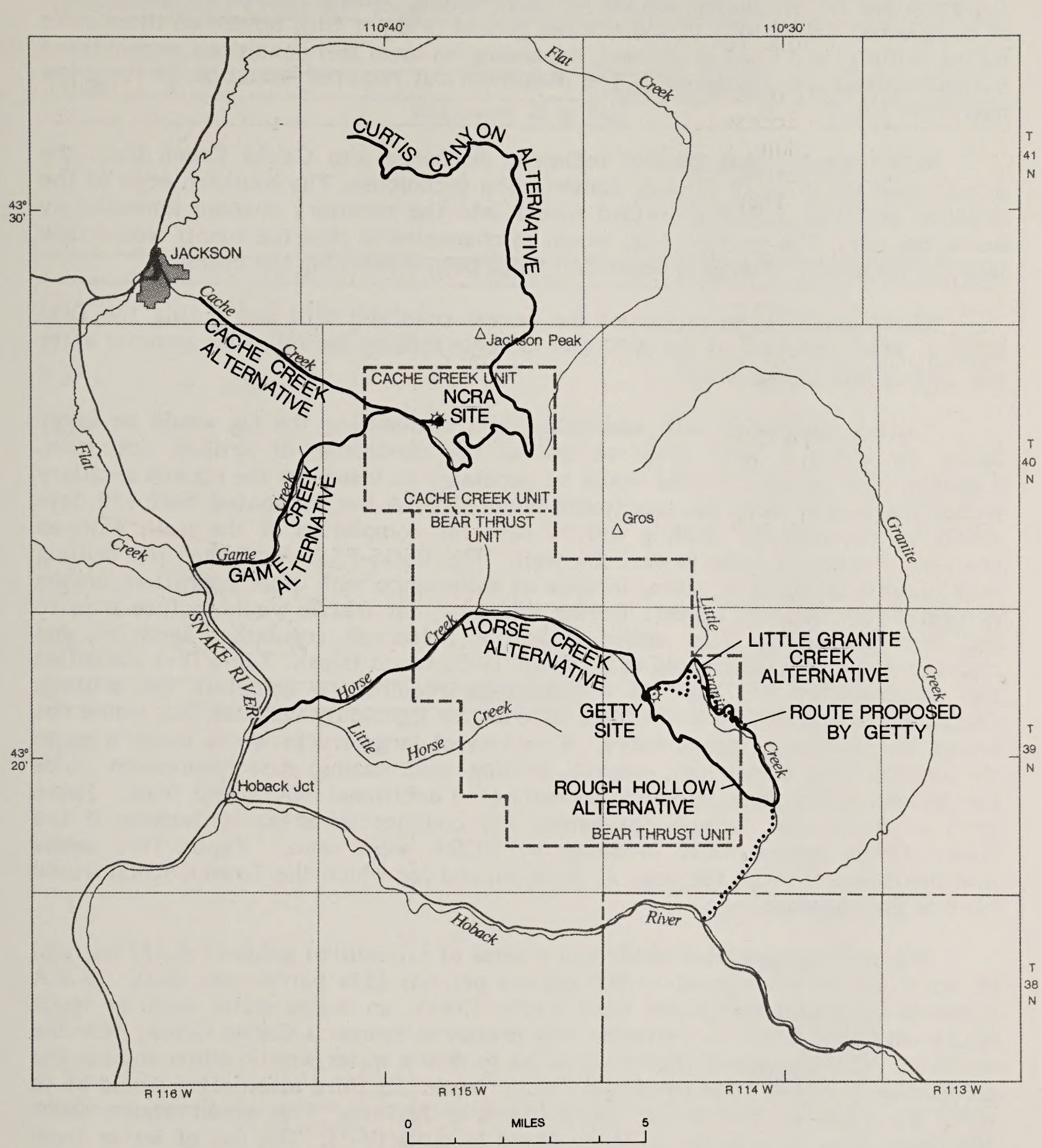


Figure IV-1.--Map showing road alternatives.

NCRA proposes that their pad and pit would disturb approximately 3 acres. Topsoil would be stockpiled for use in reclamation. The pit would be constructed of compacted native soils in undisturbed ground (and not fill), fenced on three sides during drilling, and lined or unlined, depending on local soil conditions encountered during construction of the pit. The maximum cut required would be 29 feet; the maximum fill, 21 feet.

NCRA would limit control sediment discharge into Cache Creek from the access road and drillsite through construction techniques. The southern edge of the drillsite would be sloped to retard runoff into the tributary channel immediately below the site. The western edge would be channeled so that the runoff would flow into the pit and/or through a vegetated filter before reaching the creek.

NCRA proposes to construct the access road and drill pad during the first summer after approval of the APD and to begin drilling the following summer after elk calving and spring runoff.

Traffic associated with assembling and dismantling the rig would be fairly heavy for about 1 week prior to and at the conclusion of drilling activities. Eighteen trips by large trucks would be necessary to transport the rig and ancillary equipment to and from the site (table IV-1). NCRA has estimated that 120 days would be required for drilling and 30 days for completion of the well, with an unknown amount of time to test the well. The USGS-FS believe that the drilling may require 180 days or more, in view of experience with other operations on the Bridger-Teton National Forest. During this time, car traffic would include trips to and from the rig by three shifts of drilling personnel, regulatory agencies, and maintenance crews (estimated to be about 1,400 round trips). Table IV-1 identifies the total number and type of vehicle trips required to complete the drilling. Carpooling would reduce the number of trips for light-duty vehicles, but would not lessen the number of heavy loads. A variety of large trucks would make trips to the site carrying diesel fuel, cement, drilling mud, casing, dust-suppression fluids for sprinkling the road, etc., for an estimated additional 300 round trips. These vehicles would pass through residential and commercial areas of Jackson if the Cache Creek access route proposed by NCRA were used. Figure IV-2 shows possible routes through the town of Jackson, and for which the Town Council would have to give approval.

The drilling operation would use a total of 1.7 million gallons (40,477 barrels) of water for an average of 14,000 gallons per day (334 barrels per day). NCRA proposes to obtain this water from Cache Creek, an onsite water well, or truck haul from Game Creek or Jackson. The preferred source is Cache Creek, near the wellsite. NCRA's second choice would be to drill a water well in alluvium near the confluence of Noker Mine Draw and Cache Creek. Its third alternative would be to truck the water in from either Game Creek or Jackson. This would require about 500 round trips (in addition to those listed in table IV-1). The use of water from either Cache Creek or Game Creek require a State permit. (The State of Wyoming routinely allows short-term use of surface or ground water for exploratory drilling operations.)

NCRA has proposed the following casing program: (a) 13-3/8 inch H-40 surface casing set to 1,000 feet and cemented to the surface with 800 sacks of cement, and (b) 5½-inch N-80 or K-55 (used at different depths) long-string casing to total depth (10,100 feet) and cemented in place using 200 sacks of cement. However, if, during drilling, downhole conditions dictated the need for inter

Table IV-1.--Expected vehicles trips (excluding road construction and maintenance) to the proposed Cache Creek site and the anticipated weight distribution of the vehicles

Trips	Loaded weight per vehicle (lbs)
Rig move in or out	
14	under 80,000
4	80,000 to 110,000
Drilling	
1,261	4,000 to 10,000
99	18,000
120	35,000
2	40,000
3	46,000
19	80,000
6	90,000
Completion	
147	4,000 to 10,000
15	10,000 to 20,000
33	35,000
3	40,000 to 46,000
4	60,000
12	70,000 to 80,000
2	90,000

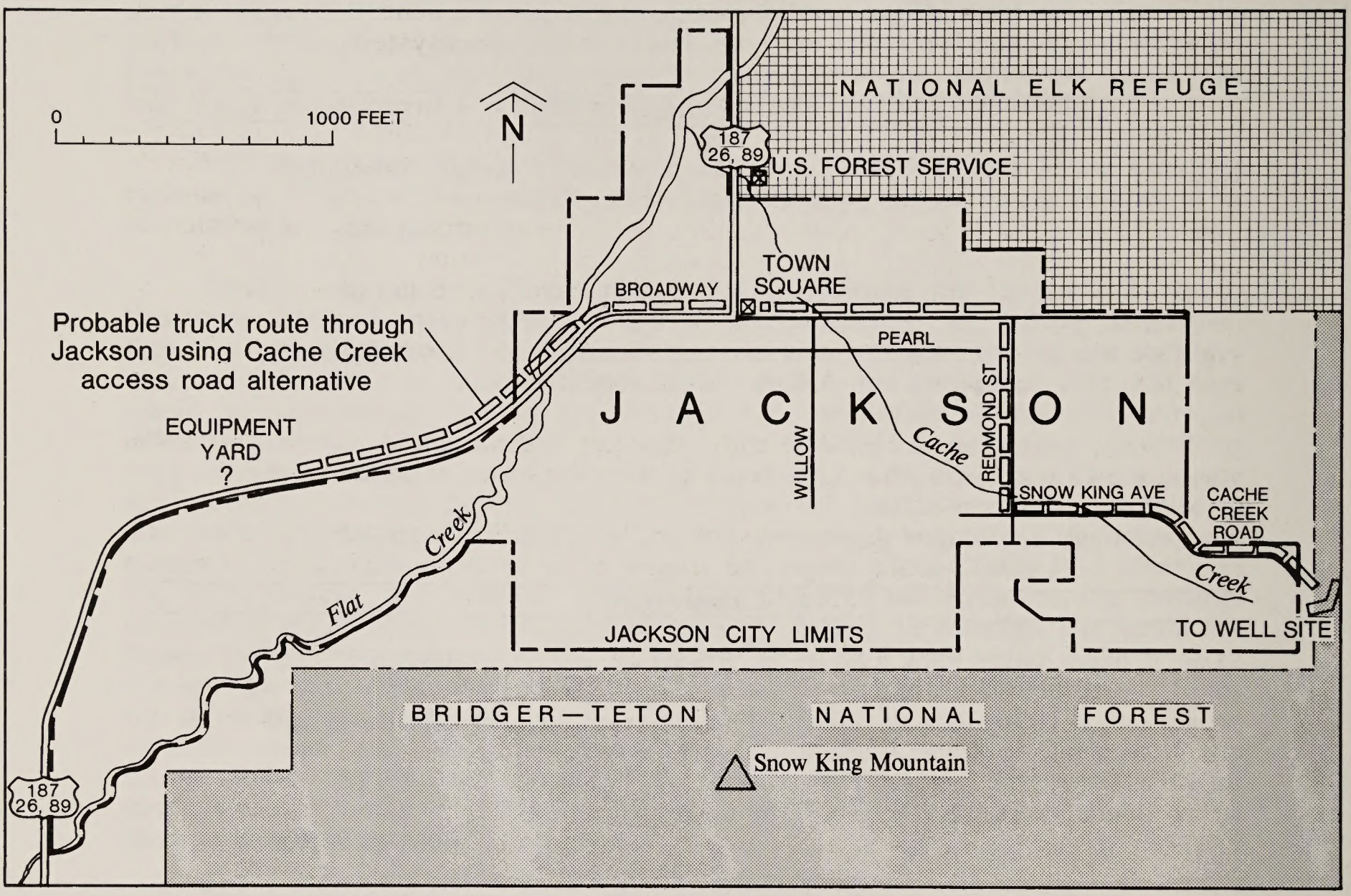


Figure IV-2.--Probable truck route through Jackson.

mediate casing, NCRA would run 3,500 feet of 9-5/8 inch K-55 casing. The drilling rig would be equipped with a double ram blowout preventer (BOP) rated to 3,000 pounds per square inch and with an annular BOP. The BOP's could be used to shut in the well if an unusual downhole condition were encountered and these drastic measures were required to control the well.

The company has indicated it would use drill mud additives with the least potential for causing water contamination (for example, by substituting ferric compounds for chromium-based compounds to regulate mud consistency). Additional details on the muds are included in the original Cache Creek EA (USGS, 1979). The drilling mud itself would be recycled in a closed system.

There are indications that NCRA might drill into a hydrogen sulfide (H_2S)-bearing zone (Phosphoria, Tensleep, or Madison), and they would comply with the proposed NTL-10 regulations (USGS-proposed safety measures). Safety International, Inc. and its appropriate subsidary companies would be retained to handle all necessary supervision, training, equipment, inspections, preparation of contingency plans, and all other phases of the operation necessary to ensure compliance. A qualified mud engineer would handle onsite details of the drilling mud program. The baseline data report on air quality includes a typical contingency plan for H_2S. Further discussion on H_2S can also be found in chapter V of this EIS, under Summary of Effects of Implementation.

When drilling approached (within 1,000 feet) a suspected H_2S-bearing zone, the site would be geared for H_2S. Some of the things that would be done are:

- Placement of H_2S monitors at critical locations around the drilling rig (these monitors are set to trigger a visual and audible alarm if H_2S is detected above about 10 ppm).

- Placement of respirators for driller use.

- Increasing the mud pH so that any H_2S found would dissociate into sulfide and hydrogen ions.

- Addition of H_2S scavengers that would form a stable compound when they came in contact with H_2S.

If H_2S were found, the well could be shut in with the BOP's, and any additional necessary safety precautions could be taken to ensure proper control of the H_2S.

The alarm system would be designed so that it could be heard at the current gate closure on the Cache Creek trail. Signs would also be used to inform the public. If H_2S were encountered during drilling operations it might also become necessary to close the Cache Creek watershed to recreation. This, of course, would depend on the concentrations of H_2S gas, subsurface geology, and other engineering factors. Public safety would be the primary consideration in making any decisions on these matters.

After drilling activities were completed, NCRA would reclaim the pad and pit areas. Trash and garbage would be collected continuously throughout the drilling operations and hauled to the Jackson sanitary landfill. All drill cuttings would be disposed of in the pit, the fourth side of which would be fenced. After

the pit was dry, it would be filled in, regraded, and revegetated according to FS specifications.

If, after completion and adequate testing, it was determined that the well was a commercial producer, NCRA would reevaluate the Cache Creek Unit. NCRA would like to install standard oil or gas pumping and treating equipment, possibly with tanks at the site inside an earthern dike. Before the well could be commercially produced, additional details would be required by the USGS and the FS on NCRA's proposed action.

If commercial quantities of oil were found, it would be possible to truck the oil to a processing plant. However, if natural gas were found, the closest main gas line that could possibly handle the supply is 52 miles south-southeast of the site. Action would be initiated to construct pipeline(s) to the site as soon as possible. In the interim, development wells would be shut in until pipeline(s) were constructed.

If commercial quantities of hydrocarbons were not discovered, or upon cessation of production, the site would be permanently abandoned. All surface equipment would be removed and the well itself plugged to USGS specifications. Cement plugs would be selectively placed in the wellbore to prevent migration of fluids (contamination) between subsurface zones or formations. The site and access roads would be restored to as near original contours as practical and reseeded according to FS specifications, unless otherwise advised by the Forest Supervisor.

This subsection has provided a brief summary of onsite drilling as proposed by NCRA. The subsections which follow outline and describe the two road access alternatives being considered by NCRA's drill request, and are summarized in figure IV-1.

1. Cache Creek Alternative A: Roading via Cache Creek

Total length from State, county or town road to site	5.49 miles
Length presently open as a forest road	3.00 miles
Length involving reopening and rehabilitation of presently closed forest road	2.09 miles
Length involving new construction	0.4 miles
Detailed breakdown:	
Along creeks	1.78 miles
Along side slopes	0.4 miles
Across flat areas	0.31 miles
Total length	2.49 miles
Switchbacks	no
Adverse grade	no
Avalanche chutes	no

This route proposed by NCRA is the shortest, has the best grade line, and requires the least new construction to reach the drillsite. Construction costs for the Cache Creek access are estimated at $572,000. This is for a 14-foot-wide all weather road from the existing road closure to the wellsite. This does not include any upgrading of town streets which would be required to accommodate heavy truck traffic through the town of Jackson. Estimated restoration costs for the same length of road are $148,000.

The proposed wellsite is approximately 5.5 miles southeast of Jackson, Wyoming, in Cache Creek Canyon. This access route, originally proposed by NCRA, involves approaching Cache Creek Canyon through residential Jackson and utilizing the Cache Creek road. The present condition of the existing road in Cache Creek varies according to location. The first 3 miles of the road from Jackson to the FS gate is in good condition and should need no additional work. The 2.0 miles of road above the FS gate is in fair to poor condition. Cache Creek has encroached and/or undercut the existing road in several places. Approximately 1.8 miles of the road is directly adjacent to the creek. About 0.4 mile of new road would be needed from the end of the existing road to reach the wellsite. The last 2 miles of existing road along Cache Creek would have to be extensively improved. NCRA would have to submit a detailed road construction plan in conformance with FS guidelines (appendix G).

2. Cache Creek Alternative B: Roading via Game Creek

Total length from State, county or town road to site	7.28 miles
Length presently open as a forest road	3.98 miles
Length involving reopening and rehabilitation of presently closed forest road	0.76 miles
Length involving new construction	2.54 miles
Detailed breakdown:	
Along creeks	0.76 miles
Along side slopes	2.12 miles
Across flat areas	0.42 miles
Total length	3.30 miles
Switchbacks	no
Adverse grade	yes, over 240 vertical feet
Avalanche chutes	no

This route would have the advantage of providing access to the site without passing through the town of Jackson. The route would require 2.5 miles of new construction and would have an adverse grade of 240 vertical feet in order to cross the saddle between Game Creek and Cache Creek. Construction costs for the Game Creek access are estimated at $785,000. This is for a 14-foot-wide all weather road from the end of the existing road to the wellsite. Estimated restoration costs for the same length of road are $150,000. That portion of the new construction between the present road closure on Game Creek and the saddle would be in a narrow draw and would result in short segments of grade appoaching 12 percent (fig. IV-1).

NCRA would have to meet FS engineering guidelines (appendix G), as in the case of the Cache Creek road access alternative. Construction of the Game Creek access road is clearly feasible in terms of standard engineering practices and could be reclaimed if it were no longer needed.

The lower existing segment of the proposed Game Creek road is fairly durable and could easily accommodate heavy truck traffic with minor upgrading. Bridges would have to be installed at several key points.

The Game Creek route passes through State of Wyoming lands for approximately one-half mile near its junction with the main highway. NCRA would have

to work out arrangements with the State, as there are no specific easements for unrestricted access.

This route would enter the Cache Creek watershed at the Game Creek Pass, remain in heavy timber, crossing Cache Creek only once, 0.8 mile below the wellsite. From the Cache Creek junction it would follow the old road/trail to the well location. Construction of the Game Creek route would create the potential for a closed loop access with the Cache Creek trail. The Wyoming Game and Fish Department feels this might encourage illegal off-road use and violation of the road closures.

3. Cache Creek Alternatives Reviewed but Discarded Because of their Impracticability

Disapproval (no-action alternative).--The USGS-FS thoroughly evaluated the disapproval or no-action alternative. This EIS points out that there are no wellsites on NCRA's leases, both less environmentally sensitive and still able to meet company drilling objectives, than the site proposed by the company. All potential sites would fall in the upper end of Cache Creek, and all would share similar concerns. So, if disapproval were considered for the particular APD under study in this EIS, it should likewise be considered for all other potential drilling sites in the Unit. A disapproval discussion clearly pertains to all potential APD's in the Unit, if the first well is to be disapproved. There is no way to skirt this issue.

The Regional Forester in Ogden, and the Director of the USGS, concluded, based on legal advice from the USDI Regional Solicitor in Denver, that disapproval is not a viable procedural option available to the USGS or FS. Therefore, it is included under alternatives considered but discarded because of their impracticability. Discussion has been provided in this EIS so that interested individuals can better understand the complex procedural actions involved.

Disapproval of drilling on a Federal oil and gas lease for environmental reasons does not automatically require Congressional action. Restrictive stipulations may sometimes be used to limit a lessee's activities. However, in the case of NCRA's Cache Creek leases, Congressional action appears to be the only way to ensure that drilling and subsequent field development would not take place. The USGS-FS requested and received legal counsel on the disapproval option from the Office of the Regional Solicitor, Rocky Mountain Region, U.S. Department of the Interior. In addition, two legal decisions were rendered by the Federal Courts in the fall of 1980, which provided guidance on these matters. The USGS and FS also thoroughly reviewed these procedural aspects with the BLM State Office in Cheyenne, Wyoming. Information transmitted by the Regional Solicitor and the BLM State Office in Cheyenne formed the basis for this subsection of the EIS.

The Regional Solicitor advises that the Secretary does not have authority to deny an APD for the leases in question on the ground that any development of the leases would result in unacceptable environmental impacts. Such a denial would be the equivalent of a cancellation of the leases and the Secretary has not been granted authority by Congress to cancel those leases for environmental reasons. It was concluded that the Secretary does have authority to suspend the leases for a reasonable period of time for resource conservation or environmental reasons, or to give him an opportunity to seek special legislation authorizing him to cancel the leases and appropriate money for that purpose.

Suspension is a legal process which relieves the lessee from making lease rental payments, prevents the lease(s) from expiring, and may prevent the lessee from conducting any operations on the lease tracts. Suspensions are allowed in certain situations such as where an EIS must be prepared or where a lessee cannot exercise his drilling rights because of extensive deliberations on the part of the Government. The Cache Creek Unit leases have been suspended by the Secretary of the Interior for this reason. (The same is true for leases in the Bear Thrust Unit.)

If Congress did not act on a disapproval recommendation within a reasonable period of time, the disapproval option would provide that the APD would be approved subject to reasonable stipulations regarding access by road.

In addition to NCRA's leases, the USGS-FS feels that the disapproval option could also include provision for eliminating all oil and gas leases within the Cache Creek watershed--as all of these share identical environmental concerns to those of NCRA's acreage.

Local recreational activities in Jackson focus on the watershed. It more or less forms a self-contained unit for cross-country skiing, hiking, backpacking, horseback riding, hunting, and fishing. Therefore, it is a logical unit to consider for special management. In fact, most area residents stressed the need for special management in view of the large, increasing recreational importance of the area.

The natural qualities of the Cache Creek drainage and the unique recreational opportunities which it provides because of its proximity to Jackson are widely recognized. Should Congress agree to a recommendation to disapprove the drilling activities and to eliminate all oil and gas leases, there would be a possibility of legislation giving recognition to these special values and directing a certain management emphasis. Lacking such legislative direction, future management and the mix of land uses within the drainage would be determined by the FS in the land management planning process. This process would recognize the recreational attributes of Cache Creek and would adopt management prescriptions which favor these values over commodity resource uses. Emphasis would be on providing recreational experiences which are dependent upon natural environments.

The USGS-FS studied the question of compensation in view of the Regional Solicitor's counsel. The geology of the Cache Creek prospect is debatable, and the geologic structure has not been substantiated by seismic exploration. The exact value of Cache Creek leases on the current oil and gas market is an unknown variable; however, NCRA obviously places value on the prospect or else they would not be interested in drilling.

NCRA's three leases in the Cache Creek Unit completely blanket the upper end of the Cache Creek watershed. Three other leases, in addition to those held by NCRA, also overlap the watershed (approximately 3,000 acres). There are portions of these leases which extend into Cache Creek (fig. IV-3) which would not be part of the Cache Creek prospect. Therefore, they might have minimal value because of limited drilling rights. (The Krug Memorandum requires unitization as a prerequisite to filing APD's. If a lease is not included in an approved unit in the Teton National Forest, there can be no drilling on it.) Getty controls through assignment these other three leases (W40240, W40241, and W40246). Several lease applications have been filed on the remaining areas within the watershed, but these lease applications have never been approved nor leases issued.

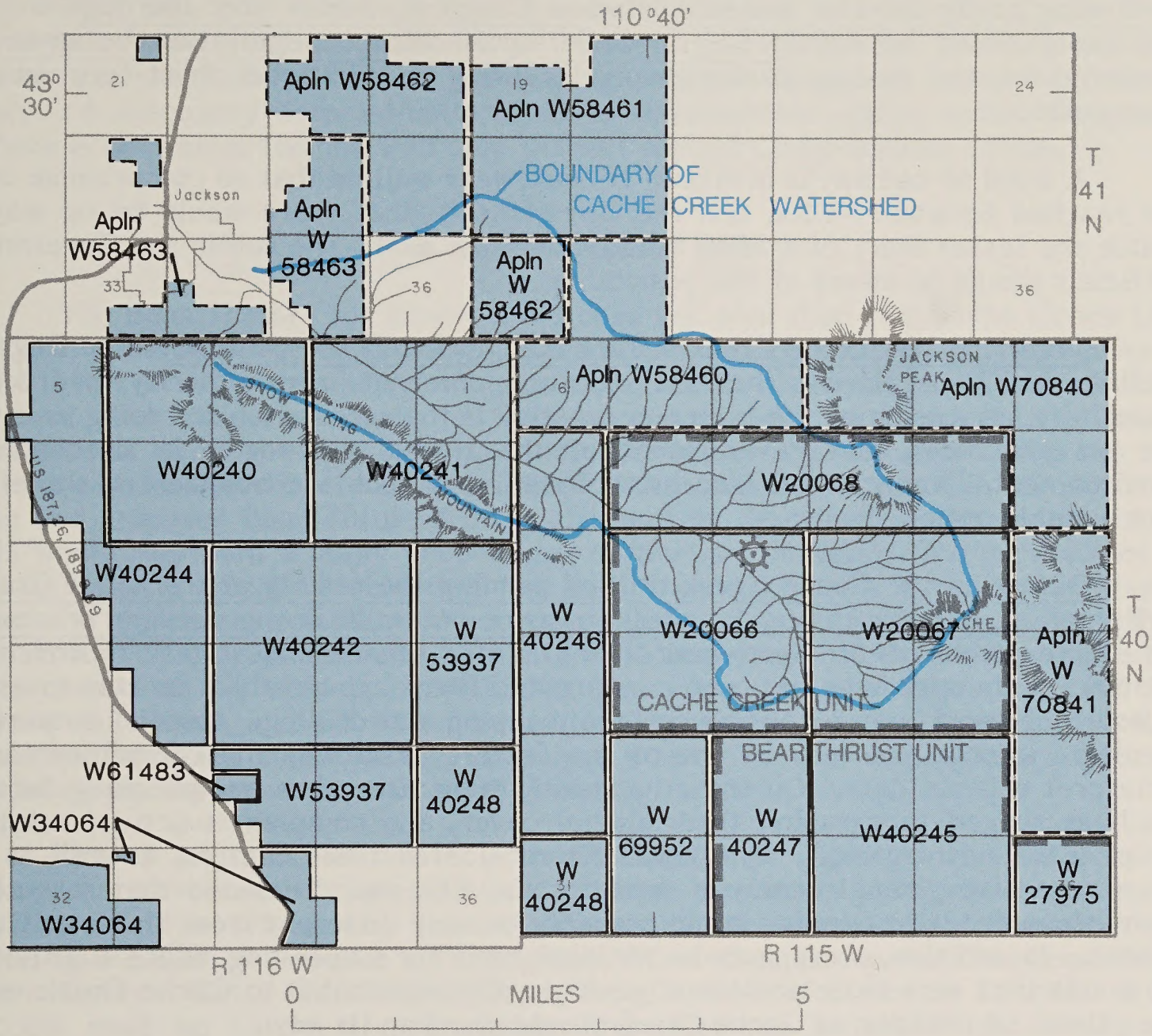


Figure IV-3.--Map showing Cache Creek watershed leases.

Several possible scenarios could be developed with Congressional approval to close out oil and gas leases within the watershed, such as exchange of the oil and gas leases for other Federal oil and gas leases of comparable value somewhere else or donation of the lease rights to a non-profit corporation for conservation purposes. Private funds might also be available for repurchase of the Cache Creek leases. If the disapproval alternative were to be ultimately selected by the Secretary of the Interior and submitted to Congress, then a more thorough analysis obviously would be required. It would entail direct negotiation between the Government and the companies involved, during an additional short-term suspension period.

A word of caution is in order: It could very well be that no compromise could be reached between NCRA and the Government--that there would be no way to value the leases short of drilling at least one test well. The public and Government officials should be aware of this possibility.

Deferring the Cache Creek drilling (i.e., indefinite suspension).--The Regional Solicitor's Office advises that the Secretary does not have authority to order an indefinite suspension of the leases in question if the only reason for doing so is that he has concluded that development of the leases will result in unacceptable environmental impacts. A suspension based upon such a conclusion is, therefore, not a viable option.

Deferring the Cache Creek drilling pending the results of the Little Granite drilling (i.e., to more throughly assess resource potential in the decision process).--One of the problems for Getty (and NCRA) is that seismic investigations within the general study area have not been conclusive. There apparently is no way to assess subsurface conditions except by surface mapping and drilling. Lack of subsurface geologic information may be one of the factors as to why the companies cannot interpret seismic data. On the other hand, there are other complicating factors, such as rugged topography, thick glacial cover, and complex structural relationships (i.e. faulting, etc.). The USGS-FS considered these factors, as well as the comprehensive geologic analysis done for the EIS, and concluded that subsurface conditions at Little Granite would probably be very different from those at Cache Creek. In addition, there may be no legal basis for suspending NCRA's activities. It is felt that very little additional geologic data applicable to Cache Creek would be gained. A decision at Cache Creek should stand on its own.

Directional drilling from outside the Cache Creek watershed.--NCRA and Government geologists have both concluded that this would not be feasible. Straight-hole drilling in itself in areas of complex geology (such as the study area of concern) is difficult. The drilling operations should therefore be positioned as near as possible directly over the target structure.

Cache Creek Helicopter Mobilization alternative.--The USGS-FS rejected this alternative based on surface disturbance, noise impacts, and safety considerations. A greatly enlarged drill pad, approximately 10 acres, would be required to accommodate the helicopter operation. It would be very difficult to construct the necessary facilities because of the restricted terrain. Noise from the frequent sorties (trips) would greatly disturb wildlife and recreational users in the canyon. Also it would not be safe to sling load materials over heavily used recreation areas. Location of a suitable staging area would be another problem.

Roading via Curtis Canyon.--The route is not considered feasible due mainly to the 2,400 vertical feet of adverse grade necessary to cross the Gros Ventre Range. There would be approximately 9 miles of new road construction and involve switchbacks as well as avalanche chutes. Further, this option would require access through the National Elk Refuge and town of Jackson.

Drill only one test well, then suspend the leases and put the Cache Creek Unit into some kind of National petroleum reserve.--Under the present legal structure, the Federal oil and gas leasing program is geared toward production only. A discovery automatically leads to development rights under the system. There is no proviso for one well only without special Congressional action.

B. BEAR THRUST UNIT

The Bear Thrust Unit covers a much larger area than the Cache Creek Unit. As such, the terrain, vegetation, wildlife, and other conditions are more complex. In a general way, the unit dominates headwaters of the Horse Creek drainage system. The primary target for Getty's proposed drilling is the Little Granite anticline, a broad geologic structure indicated by surface outcrops . This has been previously described in the Affected Environment section of this EIS. Either one of the two proposed Bear Thrust drilling alternatives described in this section of the EIS would represent a major undertaking on the part of Getty. The presence of the Little Granite anticlinal structure has been known for some time, and it may be that the expensive, complicated access problems have deterred oil companies from heretofore drilling in the area. Road access is severely limited. Favorable drill sites would all be located in the higher elevations (i.e., approximately 9,000 feet above sea level), and all would be subject to severe weather conditions. Road construction, road maintenance, logistical support for the drilling operations, and reclamation are known significant engineering factors.

Onsite logistics or onsite activities would be significantly different for conventional versus helicopter-assisted drilling. However, under either option, the drilling itself would be very similar. Discussion of Getty's proposed conventional drilling is based on Reserve Oil's original APD and supplementary correspondence from Getty. Getty Oil Company's preferred course of action is to construct an access road up Little Granite Creek and drill the proposed test well using conventional methods.

Discussion of the helicopter mobilization alternative is based on a report developed for the USGS and FS, listed in appendix C. This alternative was investigated because the Getty wellsite falls within the recommended Gros Ventre Wilderness. The Rocky Mountain Oil and Gas Association (RMOGA) was advised of the USGS-FS intentions to study helicopter-assisted drilling in May 1980. Company representatives from the drilling and petroleum industries provided technical advice to the USGS.

1. Bear Thrust Alternative A: Roading via Little Granite Creek

Reserve Oil, Inc., originally filed an application for permit to drill an exploratory well in the Bear Thrust Unit on October 16, 1979. They were subsequently acquired by Getty shortly after filing the APD. Item 19 of Reserve Oil's APD established a proposed depth of 8,000 feet to test the Frontier

Formation. Getty subsequently indicated they wished to drill to the Madison Formation with a projected total depth of 17,000 feet.

Two potential access routes were proposed by Reserve Oil, Inc., in 1979 (Rough Hollow and Little Granite Creek). The company was willing to use either route, depending upon technical feasibility. Engineering analysis for the EIS revealed that roading via Little Granite Creek is the only feasible route to the proposed wellsite (fig. IV-1). The number of vehicle trips required would be very similar to that presented for NCRA's proposed drilling in Cache Creek (table IV-1), except increased at least 30 percent because of the much deeper proposed hole depth (17,000 feet total depth for the Getty well versus 10,000 feet total depth for NCRA's well).

Getty estimates that drilling, testing, and well completion would take 10 months, provided no unexpected or adverse conditions are encountered. The company had hoped to begin site preparation and road construction in late fall of 1981, if the EIS could be completed and the well approved by that time. Drilling would begin the following spring or summer (1982). If approval were to be delayed until 1982, Getty would proceed with site preparation and drilling without delay. They would continue throughout the winter until operations were fully completed. The company expects that winter drilling would present difficult conditions for both personnel and equipment.

Approximately 15 people would be on location at all times. These would include the drilling crew, tool pusher, and geologist. They would stay in a camp somewhere near the wellsite. Several trailers or mobile camp units would be involved. Solid and liquid wastes would be handled as necessary to maintain sanitary conditions. An onsite camp would minimize road traffic. Only one or two vehicles would use the road each day, primarily to supply materials to the drill rig. A full-time guard might be stationed at the lower end of the road to control access to the wellsite.

Surface disturbances for the well location would comprise 3 to 4 acres. This includes a 3-acre pad for the drill rig and reserve pit plus fringe area for trailers and storage of drilling supplies. The size of the reserve pit(s) would be minimized as Getty would use a "total solids removal unit" (i.e., closed mud system). There may be another small area disturbed for the campsite if it is set up other than at the well location.

Water for drilling would be truck-hauled from Little Granite Creek, or obtained from an onsite water well, if possible. Getty anticipates no problem in obtaining a permit from the State of Wyoming for their drilling water. The State routinely allows short-term use of surface or ground water for exploratory drilling operations.

Hydrogen sulfide gas may or may not be a potential problem. Chevron and Rainbow Resources have been drilling in the Game Hill Unit, approximately 5 to 6 miles southeast of the proposed Getty site, and have not experienced any sour gas; however, they only drilled to Cretaceous rocks, not to Paleozoic rocks, which have sour gas. Getty would fully comply with provisions of the proposed NTL 10 (USGS H_2S guidelines) in any case. The potential dangers are much less than with NCRA's drilling at Cache Creek because of the excellent dispersion potential of the Getty wellsite, and the absence of nearby human populations or recreationists. Safety for the drill crews would be the primary concern.

In the event of a natural gas discovery, the company would shut in the well until a pipeline connection could be made. Similarly, additional development wells would be shut in until a pipeline could be constructed to the area. Construction of a new pipeline from the Big Piney, Wyoming, area to the gas field would be most likely. Procedures for obtaining the necessary pipeline rights-of-way would begin immediately. With oil production, Getty would also take action to install a pipeline. They would construct the Little Granite Creek access road to the wellsite in order to install production facilities and remove the petroleum products. Oil would be hauled out by truck--regardless of the time of year--during the interim. The oil would be collected in an onsite tank battery and periodically emptied. Additional wells would be drilled as quickly as possible to fully develop the structure. Other locations are limited by topography and directional drilling might be considered if it proves technically feasible.

Several technical problems would confront Getty if they eventually drill in the Bear Thrust Unit. Winter weather, high altitudes, and complex geology are three very significant factors. But, the Little Granite Creek access road is easily the most troublesome aspect. The road has generated intense controversy because it and the proposed wellsite would intrude the recommended Gros Ventre Wilderness. Concerns over sediment, visual impacts, and ultimate reclamation of the road and drill pad have been frequently expressed.

Engineering analysis has shown that there is no other feasible route to the Getty wellsite. Further, the USGS-FS has concluded that the Little Granite Creek road corridor would probably serve as principal access to additional exploratory wells and for field development as well--if oil or gas is discovered in commercial quantities in the Little Granite anticline.

Engineering aspects of the Little Granite Creek access road are summarized as follows:

Total length from State, county or town road to site	8.59 miles
Length presently open as a forest road	2.72 miles
Detailed breakdown of new construction:	
Along creeks	3.98 miles
Along side slopes	1.59 miles
Across flat areas	0.30 miles
Total length	5.87 miles
Switchbacks	7
Adverse grade	no
Avalanche chutes	no

The access begins at the junction of U.S. Highway 189 and the FS Granite Creek road. It parallels the lower end of Granite Creek for 1.4 miles. Access then

follows the existing Little Granite Creek road for 1.7 miles to its terminus at an old coal mining operation. (There is a current FS closure at that point.) From this point to the wellsite would require 5.9 miles of new construction along or paralleling existing pack trails. Five stream crossings would be needed (i.e., bridges).

Construction costs for the Little Granite Creek access are estimated at $819,000. This is for a 14-foot-wide all-weather road from the existing FS road closure to the wellsite. Estimated restoration costs for this same length of road are $232,000. This figure could escalate because of uncertain construction costs to traverse unstable slopes and difficult terrain in the last 1 to 1½ miles directly below the wellsite. Construction costs could go as high as $1.3 million and restoration costs as high as $400,000 to $500,000.

Road maintenance and vehicle operating costs would be high because of the adverse terrain and severe winter conditions. Winter conditions come early to the Gros Ventre area and last through late April. Estimated maintenance and operating costs are as follows:

Summer maintenance:		
Motor patrol (8 hr/day, 22 days/month = 176 hr/month)	$45/hour	$8,000/month
Total summer maintenance		$8,000/month
Winter maintenance:		
Motor patrol with blade and wing (8 hr/day, 30 days/month = 240 hr/month)	$50/hour	$12,000/month
Rotary plow (8 hr/day, 30 days/month = 240 hr/month)	$50/hour	$12,000/month
Total winter maintenance		$24,000/month
Vehicle operating costs:		
25-ton truck	$0.08/ton miles	$2.00/mile

The reconaissance survey for this road avoided major identifiable unstable slopes, steep side slopes, and marshy or boggy areas as much as possible. However, almost 4 miles of the proposed 5.9 miles of construction would be in the riparian zone. The Little Granite Creek drainage is not a broad valley bottom and the road could not be pulled away from the Creek. Construction of this road in the riparian zone would result in major changes to the local habitat types. Road construction might cut off subsurface water flow to the plant communities. The construction would require extensive earth-moving close to the stream.

Active stream erosion is naturally occurring due to high ground-water conditions and solifluction. There is an active slide area in the mile of road directly below the wellsite--although this shouldn't present any great problem to the users of the road. Several other slide areas were mapped along the lower reaches of this route. They are presently inactive but in any case will be difficult to rehabilitate when the road is eventually closed.

A FS trail, commonly known as the Highline Trail, traverses along the north margin of the Bear Thrust Unit of the Gros Ventre Mountain front. The nearness of

this trail and the opportunity to experience scenic vistas results in visual quality levels of retention or partial retention for much of the upland country (including the area around the wellsite). FS management direction normally requires that roads, drill pads, etc., should be either not visually evident to users of the trail or subordinate to the natural character of the landscape. The Little Granite Creek road generally would not be visible to most forest users, either from Granite Creek or from the main highway. It would drop off the divide rapidly and viewers from the Highline Trail would be unable to look into the Little Granite Creek drainage. The rig and camp, however, would dominate the landscape during the term of the operations. Reclamation of the drill pad should mitigate the visual intrusion to a great extent after completion or abandonment of the well. Revegetation of the wellsite would be difficult because of the high altitude and adverse weather conditions (summer snows are common and can come at any time). The FS would work closely with Getty to insure that revegetation does take place before the site is permanently abandoned.

The existing road closure at the end of the Little Granite Creek road would be maintained. A 24-hour guard might be required, depending on whether enforcement or security problems develop. The full-time guard would be a definite requirement, however, during hunting season. The Little Granite road would provide an easy route to large populations of elk. Therefore, the potential for increased, perhaps excessive, harvesting would have to be reduced by a guard and road closure.

Getty would adhere to engineering standards in the Bridger-Teton National Forest roading guidelines (appendix G), and a company inspector would be required to assure compliance. Getty would be required to submit detailed road design plans to the FS for review and approval, prior to conducting any construction activities. The same is true for reclamation.

2. Bear Thrust Alternative B: Helicopter Mobilization Alternative

This alternative seems to offer certain environmental advantages over conventional road access. However, this approach is not favored by Getty Oil Company because of up-front costs and unknown drilling conditions, which could lead to greatly increased expenditures over those of a conventional operation. It would be considered only for the initial exploratory phase. The ability to secure an onsite source of ground water (for drilling, blowout control, and camp operations) emerged as a critical factor. If such a supply could not be obtained, Getty, in order to exercise their drilling rights, would have to be permitted to use the Little Granite Creek road alternative.

A water well drilling rig would be transported by helicopter to the Little Granite wellsite at the earliest possible time. A steady supply of 50 gallons of water per minute (approximately 3,000 gallons per hour) is needed to sustain the exploratory operations during the initial phases of the oil and gas drilling. The water well rig would be used to drill a water well up to 1,000 feet deep on the mountain, to try and secure an onsite water supply. (It is believed that drilling deeper than 1,000 feet would be unlikely to obtain adequate water supplies.) Getty would have to spend approximately $300,000, (i.e., to transport a water well rig and drill a well), in order to assess the ground-water question and determine whether helicopter mobilization of the oil and gas drilling was feasible.

There are no feasible alternatives to having an onsite water source. Air lift of water from Little Granite Creek near the staging area and pumped surface water via a pipe from Little Granite Creek to the wellsite were both considered but rejected. Some pumped storage from Little Granite might be possible during the initial stages of drilling to meet the 50 gpm requirement. However, it would be impractical, even impossible, to continue such an operation. Numerous days of subzero temperature conditions would make the pipe system infeasible. There also would be a very high head (up to 1,000 feet) to overcome by pumping. This would require several lift stations with up to several thousand feet of pipe. An exposed system of lift stations, pipe, etc., no matter how well insulated, would probably freeze. Further, Little Granite Creek itself might also freeze over and become incapable of providing the required water volumes during cold weather. Helicopter transport of water would add several thousand air trips to the total costs, making the entire operation extremely expensive, if not unworkable. (That is it would be difficult enough to keep the rig supplied with diesel fuel, let alone water, as well.) Assuming that a sufficient onsite water supply could be obtained, helicopter mobilization of drilling operations could probably proceed. After the water question has been answered it would take at least 6 months to gear up for the drilling operations (i.e., order supplies and equipment, construct staging area, reconstruct Little Granite Creek road, etc.). The staging area would be constructed as quickly as possible to serve as a storage area for supplies and equipment.

An industrial-sized rubber-tired forklift/backhoe and D-5 Caterpillar bulldozer would be lifted to the site prior to any other pieces of equipment. These would be used to level an area approximately 4 acres in size to accommodate the active drilling operations. The rig, ancillary equipment, and two helipads would be set up on this leveled site. An additional 6 acres would remain in natural condition and be used for storage and a campsite. A total of 10 acres, therefore, would be occupied on the wellsite by the rig, equipment, and personnel.

The camp would consist of 15 portable buildings 10 by 28 feet in size, assembled in two rows, 150 feet long and 28 feet wide (sufficient to accommodate an onsite workforce of 30 individuals). A vault-type waste disposal system would be used, periodically emptied and hauled away. A lagoon or leach field would be more convenient, and it might be constructed if local geologic conditions prove suitable.

Drill rig personnel would work on rotating shifts: ten 12-hour shifts on duty with appropriate leave after each 10-day interval. Most likely they would have sufficient time off to return to their own homes after each 10-day term of duty.

The drill rig itself would be a Parker TBA 2000 (Transportable By Anything), capable of drilling to 20,000 feet. This resembles a standard rig except it can be broken down into small components weighing approximately 4,000 pounds. The size and depth of the proposed Getty well, however, dictates certain ancillary drilling equipment. This, in turn, requires the availability of a Boeing Chinook helicopter to transport these heavier materials to the wellsite, both during the initial set-up and again during decommissioning of the operation. Many of the heavy equipment loads can only be mobilized by the Chinook. This amounts to approximately 20 loads and includes the blowout preventers, draw works, etc., plus the bulldozer and forklift/backhoe.

The Chinook has only been used by the U.S. Military up to now. However, it will become available to the commercial market in 1982. This is the earliest the Getty well could possibly be drilled, so availability of a Chinook should not be a constraint. The Skycrane operated by Evergreen Helicopters would not have the required lifting capacity, given the altitude conditions of the Getty wellsite (approximately 9,000 feet above sea level).

The rig would be winterized (enclosed "dog house") in anticipation of extreme weather conditions, with temperatures well below 0^{o}F. Drilling would proceed 24 hours per day and throughout the winter months. Only in the case of the most severe weather would the drilling operations be suspended, and then only on a temporary basis. Safety for the drilling crews would be the primary consideration in such decisions. (The same situation would be true for any other alternative involving winter drilling.)

The total operation would take place over a 1-year period. Approximately 6,000-7,000 helicopter sorties would be required to accomplish the task. Up to 40 to 50 sorties per day would be needed in the initial stages and again during decommissioning of the site. During the drilling proper, this would drop off to 12 to 15 trips per day.

Two air corridors would be used: one up Rough Hollow, and one down Little Granite Creek, for safety considerations (i.e., no head-on collisions). This would also tend to disperse the noise from the helicopters. Emergency medical evacuation during periods of bad weather could be accomplished by using the existing Little Granite Creek trail. The trail would need only minor upgrading, primarily to clear timber, so that it could accommodate a snowcat or ATV. The trail presently terminates at a forest campsite 1 mile below the Getty wellsite, along Little Granite Creek. This would be satisfactory as personnel could be transported off the mountain to the forest camp, if necessary.

Three sites were investigated for use as staging areas. One of these, the level site at the end of the existing Little Granite Creek road is clearly most desirable. It is totally within the FS jurisdiction and no private lands are involved. A small coal mine was formerly operated nearby, and the main road to the site could accommodate heavy trucks with minor upgrading. Approximately 5 acres would have to be disturbed. This would entail regrading and surfacing the area with gravel to accommodate off-leading, storage, and two helipads. There would be controlled access to the equipment yard with a full-time guard. Crew quarters would consist of a mobile trailer, chemical toilet, mobile telephone, etc. Fuel for the drilling rig would be stored here. The trailer portion of a 5,000-gallon tank truck would be parked at the staging area and be replaced with a full tank every 4 days. An additional 20,000 gallons of diesel fuel would be stored in rubber bladders up on the wellsite, as well. This would be used for reserve purposes in the case of bad weather (amounts to a 10-day supply).

The helicopter mobilization alternative appears technically feasible, but there are differences in cost between it and conventional road access drilling. Another variable is whether the well is completed for production or merely abandoned. A well completion entails additional time for perforating and testing, whereas abandonment of a dry hole is much simpler.

Four estimates for road construction and reclamation were used to develop cost scenarios for conventional drilling. These were then compared to the figures

generated on helicopter assisted drilling. The USGS contractors conservatively estimated that road construction, road maintenance, and reclamation would be difficult and expensive. Costs for a dry hole and a completed well for both mobilization alternatives are:

	Dry hole	Completed hole
Helicopter mobilization and drilling	$ 15,896,579	$ 18,370,246
Conventional road access and drilling	$ 13,661,268	$ 15,579,435
Difference	$ 2,235,311	$ 2,790,811

These costs for either mobilization alternative include set up of equipment, drilling of the hole, logging, and decommissioning of the site. Mobilization by helicopter would add an estimated 16.4 percent to dry hole costs above those for conventional drilling, and 17.9 percent to a completed hole when expenses are based on the rationales and scenarios presented in the consultants' study. An intuitive estimate of increased costs which might accrue from helicopter mobilization if other approaches were used is 10 to 35 percent. (See the consultant's report listed in appendix C and detailed cost breakdown in appendix E for further details.)

3. Bear Thrust Alternatives Reviewed but Discarded Because of Their Impracticability

Disapproval (no-action alternative).--This alternative would consist of a Secretarial recommendation to Congress requesting authorization to cancel the Bear Thrust Unit leases and compensate the lessee(s). There appears to be no other possible wellsites within the unit less environmentally sensitive than the proposed location. That is, desirable wellsites from a geological viewpoint would all share similar environmental problems.

The cancellation/legislative proposal for the Bear Thrust Unit would be more complicated than in the case of the Cache Creek situation. There is no logical area, watershed, etc., within the Bear Thrust Unit to consider as a basis for disapproval other than on a Unit basis itself. There are 25 leases within the Bear Thrust Unit (24,900 acres) and many of these are held in multiple ownership (fig. IV-4). The Little Granite anticlinal structure is well known, and geologists feel that there is at least a moderate probability of success.

Getty recently spent $750,000 on seismic investigations in the area (summer 1980). Reserve Oil also conducted seismic studies in the same area prior to formation of the unit in 1979. Reserve Oil estimated that "there are reserves amounting to 100 billion cubic feet of gas on the Bear Thrust prospect. This converts to approximately 16 million equivalent barrels of oil." Several million dollars might be required to close out drilling rights within the unit. If there were disputes as to the value of the leases, costly, time-consuming litigation might result.

Roading via Horse Creek.--This route was rejected as an access route to Getty's proposed exploratory well because of the excessive length of narrow creek bottom impacted by this alternative (i.e., numerous stream crossings, etc.). Getty would also have to obtain access and rights-of-way across private lands near the

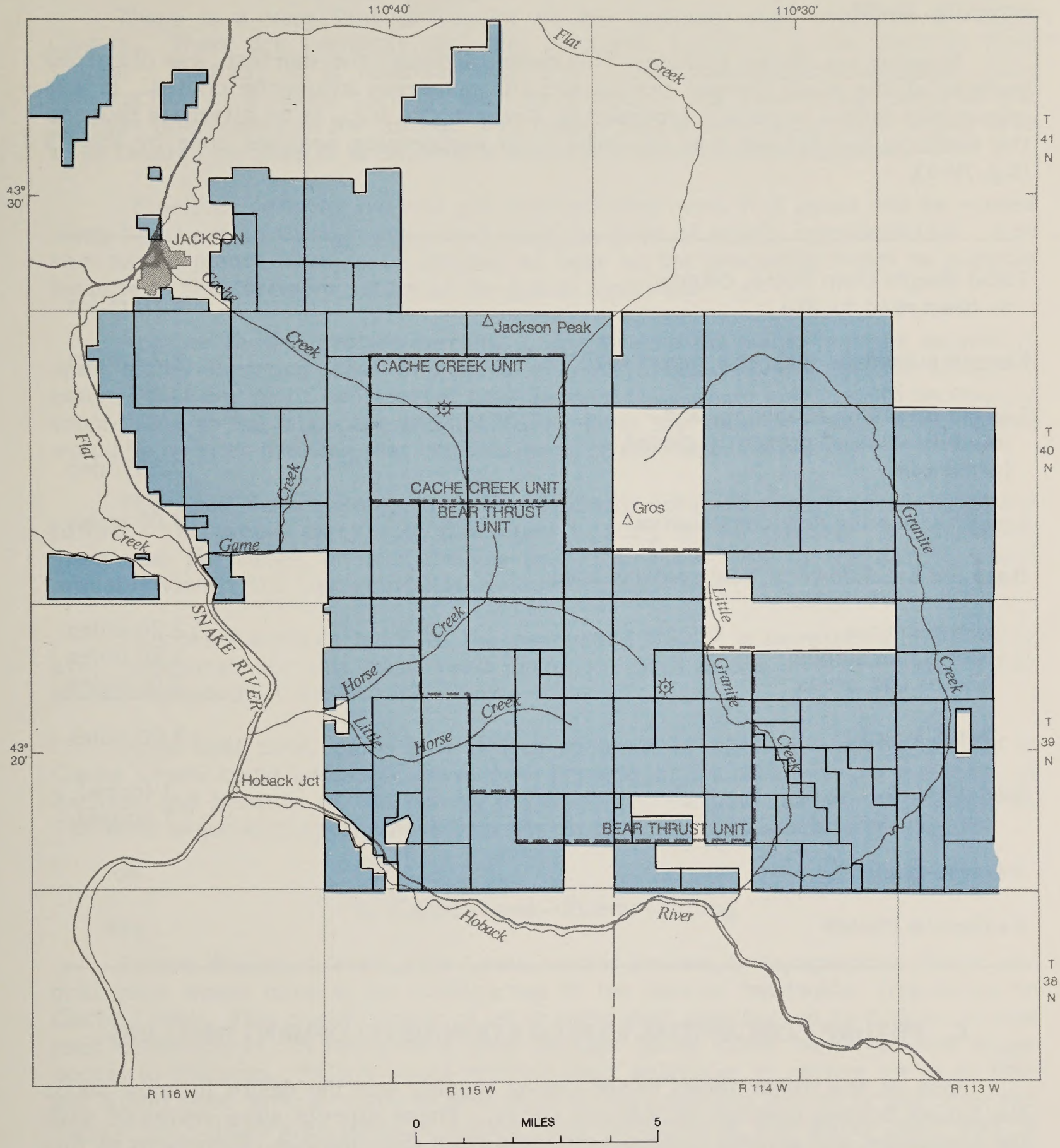


Figure IV-4.--Map showing Bear Thrust Unit leases.

mouth of Horse Creek--the owners of which are openly opposed to the project. In addition, this route would traverse important elk habitat and possibly obstruct migration routes to winter range, a State-run elk feeding ground, and an elk calving area (fig. II-10).

Roading via Rough Hollow.--This route, although the shortest, was discarded because of the much steeper terrain and the numerous avalanche chutes. It was one of two routes originally proposed by Reserve Oil, Inc., as an alternate route to the wellsite, but did not hold up under civil engineering analyses done by the FS (fig. IV-1).

Total length from State, county or town road to site	8.10 miles
Length presently open as a forest road	2.72 miles
Length involving reopening and rehabilitation of presently closed forest road	0.38 miles
Length involving new construction	5.00 miles
Detailed breakdown of new construction:	
Along creeks	2.20 miles
Along side slopes	2.80 miles
Across flat areas	0.00 miles
Total length	5.00 miles
Switchbacks	1 (draw) 1 (slope)
Adverse grade	no
Avalanche chutes	yes

C. FUTURE CONCEPTUAL EXPLORATION/DEVELOPMENT DRILLING

One of the major issues raised during scoping was the desire to know about the future drilling plans of NCRA and Getty. These aspects were reviewed with the companies and general concepts emerged from this dialogue. Reviewers of this EIS should be aware that the success ratio for exploratory drilling is low--one success for every 20 wells drilled. The entire discussion under this subsection is purely speculative, at least until one test well is drilled. A discussion of development of a hydrogen sulfide (H_2S)-contaminated gas field and the placement of a H_2S removal (sweetening) plant in the area is beyond the scope of this EIS. Placement of a sweetening plant would require extensive further environmental assessment and a major siting study. Clearly, if produced gas would have to be

treated to transport it by pipeline, both companies agree that this would present major difficulties.

There is a very limited amount of fee (private) land available in Teton County. There are currently no heavy industrial facilities in the Jackson Hole Valley. Further, it is doubtful that the County Commissioners would allow construction of a major facility, such as a natural gas sweetening plant, in the Jackson Hole Valley in the future. This means that a sweetening plant would have to be located on Federal lands, as this would be the only option available.

Pipelines carrying natural gas contaminated with H_2S could not be routed along highways or through populated areas because of safety considerations. And sweetening plants have to be located as near to the producing fields as possible because of the corrosive nature of the gas on pipelines.

Another factor involves terrain. Large sweetening plants must be located in open, higher elevation areas, in order to disperse residual pollutants. The USGS-FS assume that any plant constructed near Jackson Hole would also have to be visually subordinate to the landscape and not visible from the Jackson Hole Valley. There would be no sites meeting that criteria north of the Hoback River.

The Gros Ventre Range may be officially designated as wilderness in the future. This would carry with it a Class I rating for air quality. A sweetening plant near the range, or near the gas fields along the edge of the Range, would probably violate the high standards of Class I areas.

This brief analysis leads to the conclusion that <u>if</u> a sweetening plant were ever considered for this area, most favorable sites would involve Federal lands somewhere south of the Hoback River.

As a final note, there is a serious doubt as to whether a sour gas field in Cache Creek could be safely developed, because of its proximity to the town of Jackson and because of the heavy, dispersed recreational use of the watershed. The same arguments apply to the Bear Thrust Unit, but to a much lesser degree.

1. Cache Creek—Future Drilling

Future drilling in the Cache Creek Unit is limited by topography. Roads and drill pads would have to be constructed in the narrow headwater tributaries to Cache Creek. This might consist of up to eight drill pads and up to 6 miles of new road construction. A heavy-duty road through Game Creek would provide major access to the area. NCRA would restrict their activities to narrow strips of land but would need several miles of new road to fully develop any oil or gas reserves. Figure IV-5 illustrates possible future road corridors if the initial test well is successful, and if the company proceeds with development of a field. There are few broad areas on which to locate access roads or drill pads, so most construction would be confined to the riparian zones. NCRA would try to use directional drilling to cut down on surface disturbances, if this type of drilling proves technically feasible. Experience gained from drilling an initial well would provide information needed to evaluate the feasibility. Gas has been discovered in the Game Hill Unit, southeast of the study area (i.e., Granite Creek drainage). Natural gas, rather than oil, might similarly be found in Cache Creek. If so, development wells would be spaced on approximately 1-mile centers to develop a natural gas

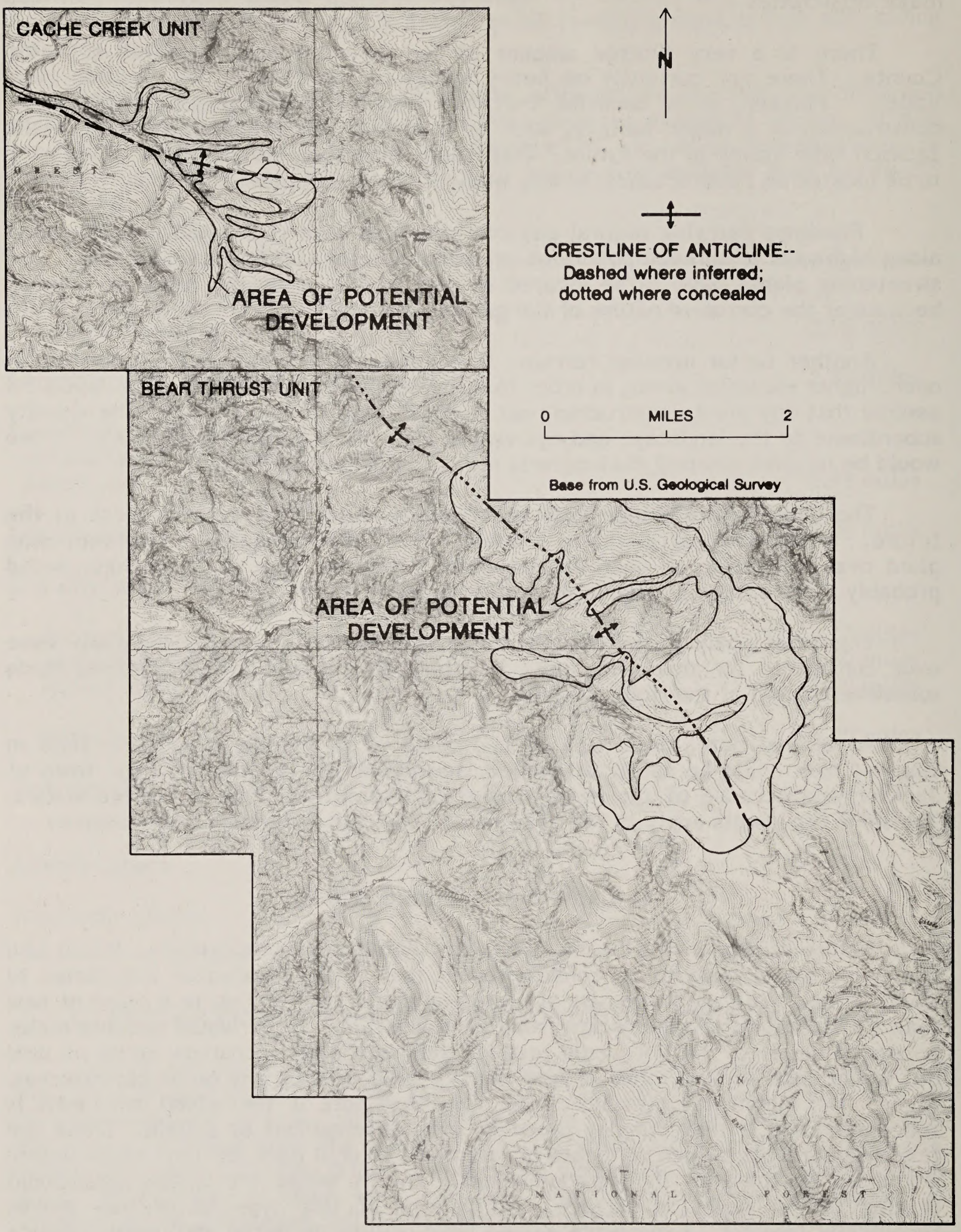


Figure IV-5.--Map showing potential areas of future development in the Cache Creek and Bear Thrust Units.

field under ideal conditions. An oil or gas reservoir coupled with fluid (condensate) production would require much closer spacing to properly develop the field. The well spacing could vary from one well every 40 acres to one well every 640 acres (1-mile centers). Heavy-duty roads would have to remain for access to the wellheads throughout the life of the field (perhaps 20 to 30 years).

Mitigation of impacts to the elk herd would be very important. Construction, drilling, and most field activities would have to be suspended from May 1 through June 15 each year to permit elk calving in the middle and upper reaches of the Cache Creek watershed. Snowcats would generally be used to gain access to wellheads during the winter months after the field is developed in order to minimize interference with recreationists. Roads would remain unplowed. Major earthmoving and road-construction activities would not be permitted until after spring runoff each year. This would leave a 4-month period--July to November--during which major earth moving and drill-rig mobilization could take place. Mild winter conditions might permit an extended season in some years.

2. Bear Thrust--Future Drilling

Development of the Bear Thrust Unit could consist of drilling eleven additional wells and construction of up to 12 miles of new roads. Facilities construction and drilling in the Bear Thrust Unit might be more complicated than in the case of Cache Creek because of technical and engineering factors. The Little Granite anticlinal structure can be observed/inferred over a distance of 4 to 5 miles. However, structural relationships at depth cannot be accurately assessed without drilling. These will remain as uncertain or unknown factors perhaps even after an initial exploratory well has been drilled. With such a large structure it is likely that more than one well would be required even during the exploratory phase to evaluate the unit's potential. Exploration could therefore consist of drilling one, two, or perhaps even more wells throughout the area.

There are no easy access routes. The USGS-FS evaluated several possible corridors and concluded that Little Granite Creek would remain as the most likely major road access to potential drilling sites within the unit. It would be used both for exploration (one to three wells possible) and for development of any oil or gas field. (This analysis assumes that roads would be used for the exploration phase, rather than helicopter mobilization, although helicopter-assisted exploration drilling might prove more desirable.)

Future drilling in the Bear Thrust Unit is limited by topography to upland benches south of the Gros Ventre Mountain front. The USGS-FS determined that road access (and, hence, drilling) in the bottom of Horse Creek may not be feasible because of steep slopes, adverse grades, and disruption of riparian habitat and elk migration routes. Therefore, additional roads in the Bear Thrust Unit probably would branch out from the head of Little Granite Creek at the initial wellsite.

They would follow the contours and remain in high upland meadows and benches. Figure IV-5 illustrates the areas most likely to experience future disturbances from additional exploration or field development. Again, topography is the primary constraint. The development scenario discussed in the foregoing subsection has assumed drilling on 1-mile centers. This may or may not be true, as in the case of the Cache Creek discussion.

D. MANAGEMENT, MITIGATION, OR MONITORING GUIDELINES

The guidelines listed in this subsection would be considered for each oil and gas operating plan to further mitigate proposed drilling and construction activities. They apply to all of the roading alternatives and, with very few exceptions, to the helicopter mobilization alternative at Little Granite Creek as well. These guidelines are included as an operational checklist to provide for additional environmental protection and regulation of the drilling activities by the USGS and FS. In effect, they are specialized management guidelines for the two specific APD's addressed in this EIS. The discussion of "Effects of Implementation," in chapter V, assumes that these guidelines may result in stipulations to be incorporated in the approved operating plans.

1. Engineering, Construction, and Operations

1. Approval of a separate road design package will be required using the FS "roading guidelines" before starting any construction work.

2. Aggregate sources will be located by the company from site(s) approved by the FS or from private lands.

3. Construction of roads or pad area with frozen earth will not be allowed.

4. Road grades will normally not exceed 8 percent; however, short pitches of up to 12 percent will be allowed.

5. All new roads will be built to a running width of maximum 12 feet with a subgrade of 14 feet.

6. Company will adhere to soils and reclamation mitigating measures developed through the USGS-FS engineering analysis of roading alternatives. (See appendix D.)

7. Bridges will be installed at all stream crossings, as a general rule. The applicant will be required to consult with the FS and USGS to establish design criteria.

8. Getty will be required to install and calibrate a continuous sediment-monitoring station on Little Granite Creek at least 3 months prior to any road construction activities in the Little Granite watershed. This station should be operated (by the company) for a time sufficient to document sediment impacts from construction including subsequent effects of reclamation. The USGS and FS assume that only periodic monitoring during field operations would be necessary.

   The USGS presently monitors sediment loads and other water quality parameters at the Cache Creek gaging station. If drilling were to be allowed in Cache Creek, the gaging station would be dropped from the Benchmark Watershed status logic system. However, the USGS would continue to operate the station in order to assess any changes to the hydrologic system. In addition, the USGS would then establish a

replacement benchmark station in some other watershed to compensate for the loss of the Cache Creek facility.

9. Adequate dust abatement will be used on both the existing roads and the newly constructed road when and where needed. Water for this purpose may be obtained from State-approved source.

10. Damage resulting from the project to any of the access roads or road structures, such as bridges, cattleguards, culverts, etc., will be repaired by the operator to FS specifications.

11. Signs meeting State and county standards, warning the public of heavy equipment use, must be placed along the access roads prior to transporting drilling equipment and during operations. At least one pilot car will precede drilling equipment to warn travelers and to direct traffic movement.

12. If snowplowing (blowing) becomes necessary, guide stakes must be set prior to snowfall to protect improvements and reduce maintenance needs. Breaks in high banks shall be constructed at 200-yard intervals to facilitate wildlife movement.

13. A FS road permit and/or road maintenance agreement will be required for road use off the leasehold.

14. The existing road closures will be maintained. If drivers do not cooperate in locking the gate after each entry, the company will be required to post a round-the-clock gatekeeper. A 24-hour guard will be required during hunting season.

15. Slash and stumps from rights-of-way clearing will be hauled to a designated site for burning or complete disposal by the company.

16. A company inspector approved by the FS will be required to be onsite during construction activities.

17. Reserve pit will require controlled compaction of dike materials by levels on lifts not to exceed 8 inches. Dike materials will be watered prior to compaction if needed.

18. Drilling operations will require the use of a closed mud system.

19. The reserve pit is to be excavated and constructed so that not more than half of the drilling fluids will be against the fill materials (deep part of pit against pad location).

20. Prior to use, the reserve pit will be approved by the FS hydrologist to determine if the materials are permeable and require lining to prevent leakage.

21. Pit fluids should be removed immediately after drilling by a method approved by the FS and the USGS.

22. Drilling operations will be shut down immediately if liquid in the pit is in danger of overflowing until fluids are lowered to a safe level. Excess fluids will be considered for disposal in one of the following manners:

    a. Test for toxic elements and treat as necessary and then broadcast spray away from live water sources.

    b. Construct additional reserve pit.

    c. Pump and truck to approved offsite disposal area.

23. Drilling operations will be shut down if leakage is found outside the pit until leakage problems are corrected.

24. If the test well is a dry hole, as much of the fluids as possible in the reserve pit will be pumped back down the hole, provided no aquifers could be contaminated by this procedure. Prior approval of the FS and the USGS must be obtained.

25. No oil (from oil changes of engines and vehicles) or solid waste will be dumped in the reserve pit.

26. A drainage ditch or low cofferdam of compacted soil or clay material will be constructed around the perimeter of the drill pad. The pad will be graded to drain toward the pit.

27. The location and construction of a flare pit or elevated flare as required by the USGS will be approved in advance.

28. Use of snowcats would generally be required for access to completed wells in the Cache Creek Unit in order to minimize interference with recreationists.

29. Fence reserve pit with woven wire at least 58 inches in height on three sides of drilling operations (four if left over winter).

30. Camps for construction workers on the National Forest will be approved by the District Ranger.

31. Drilling will be done with a diesel electric drill rig and mufflers will be installed to reduce noise levels.

2. Wildlife

1. Employees will be required to carpool and avoid, if possible, travel during twilight hours to reduce human disturbance.

2. Overhead flagging will be placed over the reserve pit to prevent birds from landing in it.

3. Employees hunting during off-time will not be permitted to drive beyond the existing road-closure gate. They must proceed beyond this point either on foot or horseback.

4. Employees hunting (off-time) will not be permitted to stay at the residential camp or on the site location. They should camp at least 1 mile from these locations.

5. Working employees accessing the drillsite by vehicle beyond the road-closure gate will not be permitted to give rides to hunters in these areas, providing them with an unequal advantage of access.

6. For the initial Cache Creek wellsite, road building the first year and drilling operations the second year should not commence until June 15 (i.e., after the elk calving period and spring runoff).

3. Timber and Fire

1. All merchantable trees removed in road and/or pad construction will be appraised and sold to the unit operator according to FSM 2462, R-4 Supplement No. 239 (S-29 Agreement).

2. Deck all of the merchantable timber and firewood materials along the side of the road for removal.

3. Unit operators and their employees will cooperate with the FS in the event of high-hazard fire conditions. Current fire management policy as applies to dispersed area use will be enforced, including any temporary fire closures necessitated by severe fire-weather conditions.

4. The company will submit a fire operations plan, including prevention and suppression measures to the FS prior to drilling activities (for summer operations only).

5. Fire suppression equipment and men will be available on location (for summer operations only).

6. The operator will be responsible for suppression costs for any wildfires they may cause on the forest.

7. Access road will be available to FS personnel in event of fire or for administrative use.

8. In the event of accidental fire, the FS will be notified as soon as possible. Notify: Bridger-Teton Fire Dispatcher, 733-5188, or Hoback Ranger District, 733-4755.

9. No burning of trash will be permitted. (Trash will be removed in an enclosed trailer or trash cage).

4. Reclamation

1. Topsoil will be stockpiled at the wellsite area to be placed back on the site for rehabilitation.

2. The pad site and other disturbed areas will be reshaped to former contours. Stockpiled topsoil will be evenly spread over the site, and the site reseeded, using FS-approved seed mixture and techniques.

3. Maintain the reserve pit fence and flagging until all fluids are dried out, hauled away, or pumped back down the hole.

4. If the well is not a producer, the road will be reclaimed by placing cut materials back into the road bed to resemble conditions existing prior to the drilling project. The road location will be reseeded with FS-approved grass seed mixture in meadow areas, and will be replanted with coniferous seedlings in timbered areas according to FS specifications. The unit operator will be responsible for reestablishing vegetation in all disturbed areas as per FS requirements to the satisfaction of the District Ranger.

5. Land Uses

1. State-approved water permit will be required.

6. Public Safety

1. Install and use only State-approved sanitation facilities.

2. Getty and NCRA will be required to comply with the proposed NTL-10 (USGS H_2S guidelines).

7. Cultural Resources

1. Getty and NCRA shall make an inventory of all archeological, paleontological, and historical sites in those areas of the lease subject to development, occupancy, or surface disturbance if they have not been previously evaluated. The survey must be made by a qualified archeologist acceptable to the surface management agency and the results of this survey provided to the surface management agency. Costs of this survey will be borne by the lessee(s). After inventory by either lessee(s)' archeologist or the surface management agency, reasonable conditions of use will be prepared to protect the sites or salvage objects of antiquity in accordance with the Antiquities Act of June 8, 1906 (34 Stat. 666; 16 USC 461-467). Costs of salvage of artifacts will be borne by the lessee(s) and all objects of antiquity salvaged will remain the property of the U.S. Government.

8. Monitoring

1. FS and USGS will monitor the following aspects of the project:

   a. Adherence to operation plan (mitigation requirements) for protection of surface resources (joint responsibility).

b. For leakage of the reserve pit (USGS responsibility).

c. Reserve pit fluid levels (USGS responsibility).

d. Road and pad construction requirements (joint responsibility).

e. Reclamation requirements.

f. Reclamation success and followup needs.

g. Noxious weed control.

2. The USGS will monitor drilling operations for safety and operational requirements.

3. Unit operators will assure adherence to the "operating plan" and before making any deviations will check with the FS representative.

CHAPTER V

EFFECTS OF IMPLEMENTATION

This section of the EIS describes the effects on the environment which would result from implementing the various exploration alternatives. Possible impacts of subsequent field development activities are also described (although these can only be considered conjectural at the present time). The Federal oil and gas leasing system conveys development rights to a lessee. The USGS-FS have therefore assumed that approval of a single well could lead to full field development in the event of a discovery (the companies obviously would not be interested in drilling if there weren't some possibility of success).

The USGS-FS assumed in chapter IV that full field development would entail construction of heavy-duty roads through the Game Creek and Little Granite Creek corridors.

There are many major and minor environmental impacts which would accrue to the proposed exploration (and potential development) activities. The analysis in this section of the EIS focuses only on the significant elements. These were identified through the scoping process and by the USGS-FS scientists.

Disapproval implies status quo, or, in the case of Cache Creek, possible enhancement of existing land use. Therefore, it was not included in the tables which follow.

Impacts are labeled in terms of "low," "moderate," and "high" on the following matrices (tables V-1 through V-6). The USGS-FS deliberated over how to present, in a meaningful way, the potential environmental impacts of the various alternatives. Relative magnitude values of "high," "moderate," or "low" seemed to represent the best way to approach the problem. Each Government scientist (FS and USGS) working on the EIS was asked to rate the magnitude of the impacts of alternatives for his specialty, according to these three levels. "Low" impact assumes very little change from status quo conditions; "moderate" implies some change to the extent that definite change would be noticeable; "high" impacts imply large changes from base values to the extent that these changes would alter or destroy critical/key habitat or highly valued activities, produce intense community conflict, be obvious to anyone, or offensive to anyone, as the case may be. These impact ratings were further augmented by brief descriptions to quantify relative values wherever this could be done. And finally, the impact ratings were thoroughly reviewed by experienced USGS and FS personnel to assure a sense of reasonableness and consistency.

In-depth analysis and documentation can be found in the various baseline reports prepared by the project scientists. These documents are incorporated by reference as documentation for the following tables. (See appendix C.) The public should feel free to contact the USGS-FS or any of the individuals responsible for preparation of the baseline data reports if there are any questions.

Table V-1.--Cache Creek Unit: exploration phase, single well

	Alternative A: Cache Creek Road	Alternative B: Game Creek Road
	Expected onsite changes.--2 to 3 acres of land cleared for a pad site, 2.1 miles of road reconstruction (8.4 acres), and 0.4 mile of new road (1.6 acres).	Expected onsite changes.--2 to 3 acres of land cleared for a pad site, 0.8 mile of road reconstruction (3.2 acres), and 2.54 miles of new road (10.2 acres).
Elements evaluated	Effects	
Soils, erosion hazard	Moderate.--Requires construction and/or upgrading of 2.5 miles of road; 1.8 miles are adjacent to Cache Creek. Rehabilitation on steep slopes along Cache Creek would be difficult. Requires disturbance of drill pad on possible unstable area.	Moderate.--Requires construction and/or upgrading of 3.3 miles of road; 0.8 mile of this road is along waterways, and involves three stream crossings. Requires disturbance of drill pad on possible unstable area.
Air quality	Low.--Cache Creek watershed has a low potential to disperse pollutants because of frequent inversions; however, only short-term pollutant sources would be present. The possibility of hydrogen sulfide (H_2S) contamination to the airshed is minimal.	Low.--Cache Creek watershed has a low potential to disperse pollutants because of frequent inversions; however, only short-term pollutant sources would be present. The possibility of hydrogen sulfide (H_2S) contamination to the airshed is minimal.
Noise	High.--Would result in a very high nuisance level to residents of Jackson and recreational users of the canyon from heavy truck traffic to service the exploratory well.	Moderate.--Would result in a nuisance to recreational users of the middle and upper reaches of Cache Creek Canyon and some disturbance to wildlife but avoid populated areas.
Surface-water hydrology	Moderate.--Possible increase in sediment load in Cache Creek due to reconstruction of the road. Floodplain hazard is moderate due to access location in narrow portions of the Canyon, along the stream. Lined pit, closed mud system, and non-toxic (Continued)	Low.--Slight potential for increase in sediment in Cache Creek. Portions of Cache Creek Road to be upgraded require only minor reconstruction. Only slight impact to Game Creek at reconstructed stream crossings. Same precautions as those discussed in (Continued)

Table V-1.--Cache Creek Unit: exploration phase, single well--Continued

Elements evaluated	Alternative A: Cache Creek Road Effects	Alternative B: Game Creek Road Effects
Surface-water hydrology--Continued	mud additives reduce the risk of surface-water contamination. Frequent onsite inspections by the USGS and FS would further reduce any chances of operational problems.	alternative A apply to this alternative.
Subsurface (groundwater) hydrology	Low.--Use of non-toxic mud additives and an adequate surface casing program would reduce this risk to a low level.	Low.--Use of non-toxic mud additives and an adequate surface casing program would reduce this risk to a low level.
Vegetation	Low.--Additional construction required to upgrade the Cache Creek access route would not involve extensive disturbance of forested areas. Basically entails reconstruction of a road already located in the riparian zone. This is the primary problem.	Moderate.--Involves new construction through a wide variety of vegetation types. Portions along steep side slopes and a new stream crossing at Cache Creek. Upgrading along the portions of Cache Creek involved with this route would produce minor impacts.
Wildlife (big game)	Moderate to high.--Temporary displacement of moose and elk populations. Loss of key winter range for moose, reduction of riparian habitat; temporary disruption of key elk calving area during drilling activities (mitigated with seasonal restriction).	Moderate to high.--Temporary displacement of moose and elk populations. Loss of key winter range for moose, reduction of riparian habitat; temporary disruption of key elk calving area during drilling activities (mitigated with seasonal restriction).
Fisheries	Moderate.--Reduced habitat; reconstruction along Cache Creek would reduce riparian vegetation and possibly increase sediment loads. Also increased access and fishing pressure could reduce Cache Creek to a non-viable fishery. A potential for spills to the aquatic system exists.	Moderate.--Less impact because of less construction in the riparian zone. Increased access and fishing pressure would impact Game Creek, less because of stocking and species present. A potential for spills to the aquatic system exists. Increased access to Cache Creek.

Table V-1.--Cache Creek Unit: exploration phase, single well--Continued

Elements evaluated	Alternative A: Cache Creek Road Effects	Alternative B: Game Creek Road Effects
Recreation	High.--Visitor use for this area is estimated at 12,000 to 16,000 recreational visitor days (RVD's). Hiking, backpacking, ski touring, and hunting would increase if well is non-productive and perhaps return to current level. This route would heavily impact many activities.	Moderate to high.--Visitor use for this combined drainage area is estimated at 10,000 to 13,000 RVD's. Preferences include back-packing, horseback riding, ski touring, hunting, and hiking. Activity could increase to 20,000 because of better access to the area and reclamation of the access road to a trail standard.
Wilderness attributes	Moderate.--Visitor use estimates for this area are 4,600 RVD's within the recommended wilderness boundary. Road to the wellsite would detract considerably from the wilderness values. Visitor use could increase to 6,400 RVD's with a dry hole. The area is affected by many competing interests and is more of a community park than a true wilderness.	Moderate.--Visitor use estimates for this area are 4,600 RVD's within the recommended wilderness boundary. Road to the wellsite would detract considerably from the wilderness values. Visitor use could increase to 6,400 RVD's with a dry hole. The area is affected by many competing interests and is more of a community park than a true wilderness.
Cultural resources (archeological sites)	Unknown.--Probable insignificant but must be further reviewed (see chapter II).	Unknown.--Probably insignificant but must be further reviewed (see chapter II).
Visual resources	High.--Road construction and upgrading would initially introduce artificial (unnatural) visual elements. Drill pad and road rehabilitation would require many years to recall natural visual occurrences. These unnatural elements would remain with a producing well. The existing trail/road along Cache Creek already present some visual intrusion.	Moderate.--Similar effects to those of alternative A, but to a lesser extent.

Table V-1.--Cache Creek Unit: exploration phase, single well--Continued

Elements evaluated	Alternative A: Cache Creek Road Effects	Alternative B: Game Creek Road Effects
Social factors (population)	Low.--Very minor population increase while drilling and very minor decline after drilling due to the transient nature of the workforce.	Low.--Very minor population increase while drilling and very minor decline after drilling due to the transient nature of the workforce.
Social factors (local culture)	High.--Oil traffic through town would result in safety problems, and conflicts in life styles and uses of the area. Most local residents would strongly resent this intrusion.	Moderate.--Conflicts in life styles and uses of the area. These impacts would be reduced under this alternative as this access route would avoid the town of Jackson.
Economic factors (economic/revenue base)	Low.--Very minor alternation of revenue base during and immediately after drilling. Very minor alteration of tourist-based economy of the area, as most are non-residents.	Low.--Very minor alternation of revenue base during and immediately after drilling. Very minor alteration of tourist-based economy of the area, as most are non-residents.
Economic factors (employment/income)	Low.--Very minor addition to the workforce of the area. The oil field workforce would be transient in nature (not more than 30 people). Approximately 35 secondary jobs possibly created.	Low.--Very minor addition to the workforce of the area. The oil field workforce would be transient in nature (not more than 30 people). Approximately 35 secondary jobs possibly created.
Economic factors (housing)	Low.--Only a very small percentage of workers would reside in the area. During exploratory drilling most workers would use motel facilities. This would be a small number of people relative to the tourist occupancy of hotels and motels in the area.	Low.--Only a very small percentage of workers would reside in the area. During exploratory drilling most workers would use motel facilities. This would be a small number of people relative to the tourist occupancy of hotels and motels in the area.

Table V-1.--Cache Creek Unit: exploration phase, single well--Continued

Elements evaluated	Alternative A: Cache Creek Road Effects	Alternative B: Game Creek Road
Economic factors (community services)	Low.--Very minor increase in demand for community services while drilling and very minor decline immediately after drilling. These demands would be insignificant in comparison to those of permanent members of the community.	Low.--Very minor increase in demand for community services while drilling and very minor decline immediately after drilling. These demands would be insignificant in comparison to those of permanent members of the community.
Contribution to Nation's energy needs	Low to moderate.--The size of the structure as interpreted by NCRA seems to indicate that its contribution of natural gas or oil would be moderate at best (although this is pure speculation).	Low to moderate.--The size of the structure as interpreted by NCRA seems to indicate that its contribution of natural gas or oil would be moderate at best (although this is pure speculation).

Table V-2.--Cache Creek Unit: field development

	Roading via Game Creek
	Expected onsite changes.--About 24 acres of land cleared for up to eight drill pads. Up to 6 miles (about 24 acres of land) new road construction.
Element evaluated	Effects
Soils, erosion hazard	Moderate.--Several miles of road in riparian zone; continued disturbance for many years over the middle and upper reaches of the watershed.
Air quality	Moderate to high.--Long-term increase in dust from roads; pollutants and odors from gathering facilities. The Cache Creek watershed has a low potential for dispersion of pollutants due to frequent inversions.
Noise	Moderate to high.--Noise levels would greatly increase during development drilling and construction of roads; such increased noise levels could last from 3 to 5 years. This would fall off and remain as a moderate intrusion because of truck traffic to service the oil or gas field.
Surface-water hydrology	Moderate to high.--Potential of spills to Cache Creek increased due to development drilling, gathering facilities, and vehicles; possible increase in sediment due to construction of roads in riparian zone. Mitigated to some extent by construction planning, drilling techniques, and supervision by USGS and FS.
Subsurface (groundwater) hydrology	Low to moderate.--Increased potential for local ground-water contamination due to increased number of drilling operations.
Vegetation	Moderate to high.--Numerous stream crossings and construction in heavily vegetated riparian zones.
Wildlife (big game)	High.--Displacement of moose and elk populations. Reduction of riparian habitat. Elimination of the Cache Creek elk calving areas due to numerous access roads and drill pads. Possible interference with migration routes between winter and summer range.

Table V-2.--Cache Creek Unit: field development--Continued

Element evaluated	Roading via Game Creek Effects
Fisheries	Moderate.--Increased potential for siltation and loss of habitat from road and pad construction. Impacts on headwater streams could degrade downstream areas--even off the unit. Increased fishing pressure would deplete the fisheries. Also, the potential for spills to the aquatic system would increase.
Recreation	High.--Would greatly reduce the 10,000-13,000 RVD's currently estimated for the combined Cache Creek-Game Creek area. This would be particularly felt by local residents who make up the largest share (90 percent) of these RVD's. Noise, trucks, and construction would preclude some activities and degrade the recreational experience for many users.
Wilderness attributes	Moderate to high.--The Cache Creek watershed is more or less treated as a community park, and does not have the degree of solitude and isolation normally attributed to units within the wilderness system. However, Cache Creek serves as a primary access route to the Gros Ventre area. Development drilling and road construction would reduce solitude, visual qualities, wildlife habitat, and undisturbed plant communities.
Cultural resources (archeological sites)	Unknown.--Few archeological sites were found in the inventory for the initial wellsite.
Visual resource	High.--Additional roads and drill pads would disrupt many scenic tributaries of Cache Creek. The intrusion would last for at least 20 to 30 years. Proper road design could reduce some impacts, but drill pads would remain as unnatural elements in the landscape.
Social factors (population)	Low.--Minimal increase in permanent population due to transient nature of the workforce. A small maintenance crew (less than 20 workers) would be required to oversee production from the developed well field.
Social factors (local culture)	High.--Development drilling for a period of 3 to 5 years close to Jackson would not go unnoticed. Most local residents would strongly resent the intrusion. The controversy over drilling versus local concerns would be highly publicized.

Table V-2.--Cache Creek Unit: field development--Continued

Element evaluated	Roading via Game Creek Effects
Economic factors (economic/revenue base)	Low to moderate.--Potential increase in severance taxes to the county. Possible decrease in sales tax and revenue related to tourism.
Economic factors (employment/income)	Low to moderate.--Field development would continue exploration impacts and then involve a small maintenance workforce (less than 20 individuals). Potential exists for reduction of tourist-related employment (steak rides, cross-country skiing, pack trips).
Economic factors (housing)	Moderate.--Only a small permanent workforce is necessary to maintain field operations. During development drilling most workers would use motel facilities; this would be a small number of people relative to the tourist occupancy of hotels and motels in Jackson. Fifty to seventy additional housing units would be needed over a 5-year period because of related service demands if both Cache Creek and Bear Thrust are developed.
Economic factors (community services)	Low to moderate.--Demands of the small permanent workforce would be insignificant in comparison to other members of the community. Could result in demands on hospital services and law enforcement during development drilling.
Contribution to Nation's energy needs	Low to moderate.--The size of the structure (surface indications of the anticlinal structure) seems to indicate that its contribution of natural gas or oil would be moderate at best, although this is pure speculation.

Table V-3.--Bear Thrust Unit: exploration phase, single well

	Alternative A: Little Granite Road	Alternative B: Helicopter
	Expected onsite changes.--2-3 acres of land cleared for a pad site, 1.7 miles of road reconstruction (6.8 acres) and 5.9 miles of new road (24 acres).	Expected onsite changes.--10 acres of land cleared for a pad site and staging area. 1.7 miles of road reconstruction (6.8 acres).
Elements evaluated	Effects	
Soils, erosion hazard	High.--Requires construction of 5.9 miles of new road, 4 miles of which would be in the riparian zone along Little Granite Creek, and five stream crossings. Route crosses potential active landslide areas. These impacts could be mitigated to some extent by proper construction techniques.	Low.--Requires construction of a large drill pad; however, this would be located on a relatively flat alpine divide. Staging area is already level and minimum additional regrading would be required.
Air quality	Low.--Short-term addition of fugitive dust, drilling rig exhaust. The Bear Thrust Unit area has good potential for dispersion of pollutants.	Low.--Short-term addition of fugitive dust, drilling rig exhaust. The Bear Thrust Unit area has good potential for dispersion of pollutants.
Noise	Low.--Minor disturbance to recreational users and wildlife. This access avoids major elk migration routes and calving areas. Noises from the drilling operation would be audible within a ½-mile radius.	Moderate to high.--Noise within the helicopter access corridors would offend users. Noise from hovering and landing at the wellsites would probably be audible to back country recreation users over a large area. This is mitigated to some extent because the activity level for recreation in the Bear Thrust high country is low.
Surface-water hydrology	Moderate to high.--Extensive construction in the riparian zone, potential for flooding of some portions and potential for increased sediment loads; little change, if any, however, in chemical quality of water.	No effect.

Table V-3.--Bear Thrust Unit: exploration phase, single well--Continued

Elements evaluated	Alternative A: Little Granite Road Effects	Alternative B: Helicopter
Subsurface (ground-water) hydrology	Low to no effect.--The drill site is located at the top of a major drainage divide.	Low to no effect. Same reasons as alternative A.
Vegetation	High.--The access road traverses a wide range of vegetation types; extensive construction within riparian zone; five stream crossings; seven switch backs. Some difficulty expected in revegetating drill pad because of subalpine conditions.	Low.--Minimal surface disturbance required for pad and staging area. Some difficulty expected in revegetating drill pad because of subalpine conditions. Problems of revegetating access road is eliminated.
Wildlife (big game)	Moderate.--This access avoids major migration routes and elk calving areas. Management of traffic and confinement of drill crews to the wellsite should mitigate many potential impacts. Moderate impacts on the elk and bighorn sheep summer range during drilling.	Low to moderate.--"Corridored" flight paths would minimize big game impacts (i.e., elk adapt to routine, confined noise). May disrupt moose in lower reaches of affected drainages.
Fisheries	Moderate.--Construction in the riparian zone and a possible increase in sediment. Creation of better access would tend to increase the fishing pressure. (This is neither a well-known nor highly used fishery at present.)	Low.--Improvements to the existing Little Granite Trail may result in slightly increased fishing pressure on Little Granite Creek.
Recreation	Low.--Visitor use for this area is estimated at less than 25,000 RVD's. Most of this use occurs along the lower portions of Little Granite and Granite Creeks, far removed from the access road and wellsite.	Low.--The use would be as in alternative A; few people would be affected by noise and aircraft in the back country and uplands, as use is presently very low. Helicopter drilling would not greatly affect hunting conditions, either.

Table V-3.--Bear Thrust Unit: exploration phase, single well--Continued

Elements evaluated	Alternative A: Little Granite Road Effects	Alternative B: Helicopter
Wilderness attributes	Moderate to high.--The access road, rehabilitated or otherwise, would intrude the recommended wilderness. The drillsite is 3 miles within the boundaries of the recommended Gros Ventre Wilderness. The drillsite would be visible over a great distance because of the open terrain and its location on a high divide. Management of vehicular movement and drilling personnel should mitigate the intrusion to some extent.	Low to Moderate.--The large drill pad, equipment yard, and campsite would be visible to many users of the Gros Ventre high country. The sight of helicopters would be almost continuous for a a period of 1 year. These impacts would largely disappear with cessation of exploration.
Cultural resources (archeological sites)	Unknown.--No archeological sites were found along the proposed road access route. One site near the proposed well location must be further evaluated (see chapter II).	Unknown.--One site near the proposed well location must be further evaluated (see chapter II).
Visual resource	Moderate.--Road scars would be visible for many years. The drill pad would also introduce unnatural visual elements for the duration of exploration.	Low to moderate.--Drill pad and helicopters would introduce unnatural visual elements for the duration of exploration.
Social factors (population)	Low.--Very minor increase in population while drilling, many of the workers would camp near the wellsite. Drilling in Granite Creek (about 6 miles south of the Little Granite proposed wellsite) has had minimal impacts on the town of Jackson. It is anticipated that all impacts from Getty's proposed drilling on social and economic conditions would be similar.	Low.--Very minor increase in population while drilling, many of the workers would camp near the wellsite. Drilling in Granite Creek (about 6 miles south of the Little Granite proposed wellsite) has had minimal impacts on the town of Jackson. It is anticipated that all impacts from Getty's proposed drilling on social and economic conditions would be similar.

Table V-3.--Bear Thrust Unit: exploration phase, single well--Continued

Elements evaluated	Alternative A: Little Granite Road Effects	Alternative B: Helicopter Effects
Social factors (local culture)	Low.--Drilling in Granite Creek (about 6 miles south of the Little Granite proposed wellsite) has had minimal impacts on the town of Jackson. It is anticipated that all impacts from Getty's proposed drilling on social and economic conditions would be similar.	Low.--Drilling in Granite Creek (about 6 miles south of the Little Granite proposed wellsite) has had minimal impacts on the town of Jackson. It is anticipated that all impacts from Getty's proposed drilling on social and economic conditions would be similar.
Economic factors (economic/revenue base)	Low.--Very minor alteration of the area's tourist-based economy. The wellsite and access route would not intrude on the town of Jackson or the Jackson Hole Valley.	Low.--Very minor alteration of the area's tourist-based economy. The wellsite and access route would not intrude on the town of Jackson or the Jackson Hole Valley.
Economic factors (employment/income)	Low.--Only a small transitory workforce (20-30 individuals). Most would reside in a camp somewhere near the wellsite.	Low.--Larger workforce required (up to 75 individuals) to set up and decommission the program. This would drop to 30± individuals who would reside in an onsite camp during the actual drilling operations. Few would spend their time off in the town of Jackson.
Economic factors (housing)	Low.--Very minor increase in housing demand during drilling (if any).	Low.--Very minor increase in housing demand during drilling (if any).
Economic factors (community services)	Low.--Very minor increase in demand for community services during drilling phase.	Low.--Very minor increase in demand for community services during drilling phase.
Contribute to Nation's energy needs	Moderate.--The size of the geologic structure and inferred subsurface conditions indicate a moderate potential for oil/gas. (Pure speculation without drilling, however.)	Moderate.--The size of the geologic structure and inferred subsurface conditions indicate a moderate potential for oil/gas. (Pure speculation without drilling, however.)

Table V-4.--Bear Thrust Unit: field development

	Little Granite Road
	Expected onsite changes.--About 36 acres of land cleared for up to 12 drill pads. About 48 acres of land cleared for new road construction (12 miles of trunk roads).
Element evaluated	Effects
Soils, erosion hazard	High.--Long-term increase in siltation from continued use and maintenance of the road along Little Granite Creek.
Air quality	Low to moderate.--Long-term addition of fugitive dust, odors from gathering facilities, and exhaust from drill rigs. The Bear Thrust Unit area has a good potential for dispersion of pollutants.
Noise	Moderate.--Some disturbance to wildlife and recreational users of the area. Highest during drilling; then low to moderate after full field development (primarily due to maintenance vehicles).
Surface-water hydrology	Moderate to high.--Increased siltation/sedimentation in Little Granite Creek due to long-term use and maintenance of the access road. No major changes in chemical quality, however.
Subsurface (groundwater) hydrology	Low to no effect.
Vegetation	High.--Surface disturbance of subalpine terrain may prove difficult to revegetate (up to 84 acres involved, including 12 miles of new road).
Wildlife (big game)	Moderate to high.--High impacts on bighorn sheep and moderate on elk during development drilling (intrusion of summer range and possible disruption of migration routes). These impacts would fall off after field development is completed, provided strong enforcement is employed to control maintenance vehicles and movement of recreational users to the area.
Fisheries	Moderate.--Siltation from road use, increased fishing pressure, potential for spills from multiple wells in the headwaters of Horse Creek all add to the situation. (This is neither a well-known nor highly used fishery at present.)

Table V-4.--Bear Thrust Unit: field development--Continued

Element evaluated	Little Granite Road Effects
Recreation	Low to moderate.--Most recreational use would occur in the lower reaches of Little Granite-Granite Creeks. Development in the high country would disrupt only a small number of forest users.
Wilderness attributes	High.--Construction of 12 miles of new road, multiple drill pads, over a 3- to 5-year period, plus use of these roads by maintenance vehicles for 20-30 years would intrude the recommended wilderness.
Cultural resources (archeological sites)	Unknown.--Very few archeological sites were found during inventory studies for the initial wellsite.
Visual resource	Moderate to high.--Road construction and drill pads would introduce unnatural visual elements. Both would remain visible for duration of project (20-30 years).
Social factors (population)	Low.--Minimal increase in permanent population due to transient nature of the workforce. A small maintenance crew would be required to oversee production from the developed well field.
Social factors (local culture)	Low to moderate.--Development drilling for a period of 3 to 5 years would have some impacts to Jackson's present tourist-recreation image. Potential of conflicts in life styles, uses of the area, and interests between residents and non-residents, although drilling at Granite Creek has produced minimal impacts in this regard.
Economic factors (economic/revenue base)	Low.--Potential increase in severance taxes to the county. Possible decrease in sales tax and revenue related to tourism; however, the well sites would not intrude on the town of Jackson or the Jackson Hole Valley. Therefore, the impact is considered low.

Table V-4.--Bear Thrust Unit: field development--Continued

Element evaluated	Little Granite Road Effects
Economic factors (employment/income)	Low.--Field development would involve a small permanent workforce (less than 20 individuals). A slight potential exists for reductions of tourist-related employment.
Economic factors	Moderate.--A large share of the development drilling workforce would be transitory. Fifty to seventy additional housing units would be needed over a 5-year period because of related service demands.
Economic factors (community services)	Low to moderate.--Minor long-term increase in demand for community services.
Contribution to Nation's energy needs	Moderate.--The site of the structure and inferred subsurface conditions indicate a moderate potential for oil/gas. (Pure speculation without drilling, however.)

Table V-5.--Cache Creek Unit: effects of implementation summary

Element	Alternative A (exploratory drilling: Cache Creek access)	Alternative B (exploratory drilling: Game Creek access)	Field development
Soils	Moderate.	Moderate.	Moderate.
Air quality	Low.	Low.	Moderate to high.
Noise	**High.**	Moderate.	Moderate to high.
Surface water	Moderate.	Low.	Moderate to high.
Ground water	Low.	Low.	Low to moderate.
Vegetation	Low.	Moderate.	Moderate to high.
Wildlife	Moderate to high.	Moderate to high.	**High.**
Fisheries	Moderate.	Moderate.	Moderate.
Recreation	**High.**	Moderate to high.	**High.**
Wilderness	Moderate.	Moderate.	Moderate to high.
Cultural resources	Low.	Low.	Unknown.
Visual resources	**High.**	Moderate.	**High.**
Population	Low.	Low.	Low.
Local culture	**High.**	Moderate.	**High.**
Economics	Low.	Low.	Low to moderate.
Employment	Low.	Low.	Low to moderate.
Housing	Low.	Low.	Moderate.
Community services	Low.	Low.	Low to moderate.
Contribution to Nation's energy needs	Low to moderate.	Low to moderate.	Low to moderate.

Table V-6.--Bear Thrust Unit: effects of implementation summary

Element	Alternative A (exploratory drilling: Little Granite access)	Alternative B (exploratory drilling: helicopter mobilization)	Field development
Soils	**High.**	Low.	**High.**
Air quality	Low.	Low.	Low to moderate.
Noise	Low.	Moderate to high.	Moderate.
Surface water	Moderate to high.	No effect.	Moderate to high.
Ground water	Low to no effect.	Low to no effect.	Low to no effect.
Vegetation	**High.**	Low.	**High.**
Wildlife	Moderate.	Low to moderate.	Moderate to high.
Fisheries	Moderate.	Low.	Moderate.
Recreation	Low.	Low.	Low to moderate.
Wilderness	Moderate to high.	Low to moderate.	**High.**
Cultural resources	Unknown.	Unknown.	Unknown.
Visual resources	Moderate.	Low.	Moderate to high.
Population	Low.	Low.	Low.
Local culture	Low.	Low.	Low to moderate.
Economics	Low.	Low.	Low.
Employment	Low.	Low.	Low.
Housing	Low.	Low.	Moderate.
Community services	Low.	Low.	Low to moderate.
Contribution to Nation's energy needs	Moderate.	Moderate.	Moderate.

Summary of the Effects of Implementation

The foregoing charts are useful in that they highlight and simplify the effects of implementation. Some of these effects deserve additional explanation, however, in order to put them in proper perspective. Effects rated "moderate to high" or "high" fall in this category. Similarly, several effects rated "low" were considered issues during the scoping phase of this EIS and require additional documentation. This subsection provides supplementary analysis. Additional detailed analysis of all of these effects can be found in the various supplementary reports prepared for this EIS. The USGS-FS have not attempted to rehash all of these reports (as previously stated) but have concluded that a condensed analysis of certain elements is necessary to understand the situation. It is important to keep in mind that the effects of field development are highly speculative. The charts may not totally represent the development situation, particularly if the geologic structure were to be different from that inferred by NCRA (or Getty).

Cache Creek Unit

Air quality.--The effects on air quality are rated low for a single well but moderate to high for field development. The USGS, in conjunction with the U.S. Environmental Protection Agency (EPA), Region VIII (Denver), analyzed various H_2S well blowout situations in view of the proximity of the Cache Creek well to Jackson. Meteorological conditions such as stability of the air and/or presence of any inversions, along with volume of gas released, concentration of the H_2S, and topography are significant factors. A worst-case meteorological condition was used as a basis to predict possible effects on residential areas at the mouth of the Cache Creek Canyon. This analysis assumed very stable air (i.e., virtually no turbulence or mixing), coupled with a blowout well releasing 5 million cubic feet of gas per day, containing 15 percent H_2S. The analysis indicated that H_2S concentrations passing an individual at the mouth of the canyon would be slightly less than 2 parts per million (ppm). H_2S would tend to pool and accumulate in low areas because of the gas's high density. If a large uncontrolled blowout were to persist for 12 hours during worst-case meteorological conditions, H_2S concentrations could build up to 15 ppm near the mouth of the canyon. This would result in noxious odors, but not sufficient H_2S concentration to result in permanent injury or asphyxiation. The canyon would be closed to all foot traffic in such an event.

The USGS-FS are certain that numerous Federal and State regulatory agencies, and company officials, would be mobilized in the event of a well blowout to evaluate the situation. In all likelihood, the well would be brought under control within a short time. Residents in the town of Jackson would be well-informed and advised of any necessary safety precautions. The probability of this kind of event is very low, and normal safety procedures should mitigate potential problems. These are described in the alternatives chapter of this EIS. H_2S is encountered as a contaminant in natural gas throughout the western United States. Company geologists are aware of the geologic strata which most commonly contain H_2S, and drill crews automatically take precautions where these zones are found; however, accidents can happen.

The Cache Creek drainage presents special difficulties in air quality, with a potential for high impacts due to strong drainage winds. Odors and dust from vehicular use of the access roads would tend to accumulate in the watershed because of frequent inversions and then be transported down-canyon to Jackson because of because of recurrent drainage winds. Hydrocarbon odors are noticable

in many developed gas fields. These odors may not violate any air quality standards, but none the less are offensive. The type of hydrocarbons found (oil, natural gas, gas contaminated with H_2S), and well spacing, would greatly affect the situation.

Noise.--Noise impacts are rated high for the Cache Creek route, moderate for the Game Creek route, and moderate to high for field development. If roads in the town of Jackson are utilized for access to NCRA's Cache Creek wellsite, noise levels would be intermittently increased over that of a typical quiet residential street (50 dBA) by as much as 35 dBA. This would result in a daytime nuisance to residents of the area and a high level of nighttime sleep interference. One of the mitigating measures originally thought possible for this route was to require nighttime movement of vehicles, so as to avoid daytime traffic in town. If appears that solving one problem would only create another under this alternative.

Drill rig noise drops off rapidly and would approach background levels beyond ½ mile. However, within a ¼- to ½-mile radius, wildlife would tend to be driven away or otherwise affected by the noise. For individual wellsites, this impact in not very significant; however, for a developing well field these influence zones would overlap and have an adverse effect on wildlife in the area. Recreationists would find the noise intrusion very offensive during the 3 to 5 years necessary to develop any well field. Long-term use of the roads by maintenance vehicles and possibly the noise from a compressor station would also intrude on the solitude of Cache Creek.

Surface water.--Surface water effects are rated moderate for the Cache Creek route, low for the Game Creek route, and moderate to high for field development. Reconstruction of the Cache Creek trail would clearly result in some siltation, and the loss of riparian vegetation. This in turn could affect water temperature (i.e., loss of shading) as well. The USGS-FS believe that the changes would not violate any water quality standards; however, a slight increase in sediment levels is probable. Use of the Game Creek route would produce lesser impacts, since a road already exists along Game Creek. Further, this alternative would involve much less reconstruction of the Cache Creek trail. Beaver ponds on Game Creek would also trap sediment so that little if any change in sediment levels would be measurable at the mouth of Game Creek. Field development greatly increases the potential for spills and more erosion (from drilling, maintenance vehicles, pipelines, and access routes), particularly in the headwaters area of Cache Creek--hence the moderate to high rating.

Vegetation.--The effects on vegetation would be moderate to high with field development. This is based on probable construction of up to 6 miles (24 acres) of new roads in the headwaters area of Cache Creek, primarily in narrow zones of riparian vegetation along the stream bottoms. This type of vegetation is very important to all of the animals in the area and might be very difficult to reestablish with reclamation techniques because of its diversity. Cuts for field development access roads would tend to incept subsurface water and further affect riparian habitat. Figure IV-4 shows that road construction for field development could involve virtually all of the headwater tributaries of Cache Creek. If this were the case, the effects on vegetation would be high because of the disproportionate importance of riparian habitat.

Wildlife.--Wildlife effects are rated as moderate to high for either road access route and high for field development. Construction of both the road and

drill pad, noise, drilling personnel, vehicular movement, operations within the elk calving area--all would effect the wildlife. Approximately 1,850 elk occupy the Cache Creek-Bear Thrust EIS study area. Perhaps half of these are female, and possibly half again are of bearing age (400 to 500 animals). The wildlife experts involved in this EIS estimate that 75 to 100 elk calve in the Cache Creek area. Disruption of calving in Cache Creek could therefore ultimately affect 20 to 25 percent of the elk herd's population in the combined Cache Creek-Bear Thrust study area.

Construction of the access road and initial drill pad the first year after approval would not be allowed until after the elk calving season (May 15 to June 15). Disturbance of the wildlife would be less important after this has taken place. However, once drilling gets underway, it would be impractical to shut down the rig and totally suspend all activities because of the animals. This might interfere with elk calving the second year. Vehicular use of either the Cache Creek route or the Game Creek route would tend to disrupt elk or moose wintering in the riparian zones. For a single well this would be only a temporary disturbance of 12 to 18 months. Field development, which might involve drilling of six to eight more wells over a 5-year period, would affect the animals to a much greater extent. Long-term use of the access roads for maintenance operations over 20 to 30 years would tend to force the animals out of the area. This would result in increased habitat competition in adjacent areas, and lead to a decline in the herds. The USGS-FS conclude it would be impractical to suspend all maintenance activities to accommodate elk calving, once the field has been developed. If a major field were discovered, NCRA might be required to conduct long-term reserach on animal habitat, and elk and moose populations in the Cache Creek area, in order to properly evaluate the situation. The road system would provide much greater access to the elk herds and would probably result in a greatly increased hunter kill or harvest.

Recreation.--Recreation effects are rated high for the Cache Creek route, moderate to high for the Game Creek route, and high for field development. Analysis of user data assembled by the Hoback Ranger District shows approximately 16,000 recreational visitor days (RVD's) for the combined Game Creek-Cache Creek area (Recreation Inventory Management System, 1980); at least 90 percent of this use is by local residents. (The total population of Teton County is about 9,000.) By way of comparison, more than 100,000 RVD's are attributable to typical trails in the Grand Teton National Park; this use is by 3 million to 4 million annual visitors, predominantly nonresidents of Teton County.

Heavy use in the Cache Creek watershed occurs in the lower reaches. A truck road in this area would compromise or curtail several types of activities. All of the Cache Creek-Game Creek area experiences moderate use, relative to other places in the Hoback Ranger District. Use of either road access, the intrusion of the well pad, and the presence of the drilling rig itself would all affect the high quality outdoor experience which currently exists. Field development over a 5-year period, followed by maintenance activities involving long-term presence of heavy duty roads, would greatly affect the esthetics of the area--solitude and visual experience in particular. Development drilling could interfere with camping, horse back riding, cross country skiing, snowmobiling, hiking, and other activities which currently take place throughout the watershed.

Wilderness.--Wilderness effects are rated as moderate to high for field development. The RARE II recommended Gros Ventre Wilderness boundary falls

within ¼-mile of NCRA's proposed wellsite. The wellsite itself and both road access routes are outside the wilderness boundary. However, most of the Cache Creek Unit falls within the recommended wilderness area, and future development drilling would clearly involve drilling and road construction within the wilderness boundary. The Cache Creek watershed, as a whole, is not a wilderness in the sense that it is not remote, isolated, and untouched by man's activities. The area is more of a community park than a true wilderness. Field development would greatly affect the esthetics of Cache Creek, which serves as a major access route to the Gros Ventre area. Most wilderness advocates would view field development of the Cache Creek watershed as a major intrusion to the Gros Ventre area.

Visual resources.--The effects on visual resources are rated high for the Cache Creek route, moderate for the Game Creek route, and high for field development. Cache Creek presents a long, unbroken valley to the eye. Its forested slopes show no unnatural elements. Elongate ridges to the north and south, on either side of the valley, tend to isolate it from surrounding drainages. High peaks above timberline form a backdrop in the headwaters area. The valley is heavily used by recreationists and this increases the importance of the visual experience. For these reasons (diversity of form, use, and esthetics) visual management calls for retention. Partial retention is recommended in the Game Creek area. Reconstruction of the Cache Creek road, along with attendant stream channel stabilization in the lower reaches, would introduce many unnatural elements in this heavily used area. The Game Creek route avoids the heavily used lower portion of Cache Creek. Further, construction of new road in the Game Creek watershed would disrupt areas managed for partial retention only. NCRA's Cache Creek well would not be visible from Jackson for either access alternative. Field development in the Cache Creek watershed would introduce unnatural elements throughout the headwaters area, due to roads and drill pads. All of the area is recommended for retention. Heavy duty roads and well pads would have to exist throughout the 20 to 30 year life of any developed well field.

Local culture.--Local culture effects would be high for the Cache Creek route, moderate for the Game Creek route, and high for field development. Other socioeconomic impacts are judged to be low or low to moderate. Use of the Cache Creek access route alternative would produce intense controversy in Jackson for a variety of reasons. Incidents between local people and drilling personnel probably would occur throughout the 12- to 18-month period required to drill the well if the Cache Creek route were utilized. Controversy over the access road and drilling would receive widespread publicity. This might in turn affect the tourism posture of Jackson. People throughout the United States and other countries visit the Jackson area because of its location near Grand Teton National Park and Yellowstone, and because of winter skiing. Cache Creek is not widely used by these outsiders, but is more of a local playground. Any detraction from Jackson's tourist image (which is that of a high-quality environment) could result in a decline in tourism income. Even a small percentage decline in tourist income, estimated at well over $50 million per year, would be significant. A long, prolonged, well-publicized conflict over field development might produce such effects. This is pure speculation; however, it is very clear that field development would be very controversial.

Bear Thrust Unit

Soils.--The effects on soils would be high for the Little Granite road access alternative, and high for field development. Construction of a 4.9-mile access road

in the narrow confines of Little Granite Creek, along with five bridge crossings, would disrupt productive soils in the valley bottom. The road would traverse several debris fans and landslide areas; the mile of road just below the wellsite appears to be particularly difficult to construct because of an active slide. The geologic materials present in the upper reaches (shales and silty material) would erode rapidly once they were disturbed. Initial construction activities would produce the greatest effects. USGS-FS engineers believe that soil conditions would tend to stabilize within 1 to 2 years after proper drainage and road surfacing is accomplished, and after vegetation is re-established on disturbed slopes. Long term heavy use of the Little Granite road for field operations would require continuous maintenance to prevent sediment production and maintain slope stability.

The current mechanism for sediment production in the Little Granite-Horse Creek drainages was described previously in chapter II. Overland flow does not currently carry sediment to the streams, nor is gullying important. The slopes are mantled (armored) with vegetation and the stream banks and upland areas are stable. Construction and use of the Little Granite access road, along with 12 miles of new roads in the high country could alter the situation. The section on surface-water effects describes additional monitoring recommendations.

Noise.--Noise effects would be moderate to high under the helicopter mobilization alternative. The USGS-FS have no direct measurements of noise from a helicopter-assisted drilling operation. But it is apparent that the constant hovering and 6,000 to 7,000 sorties during a year's period would affect noise levels over a 2 to 3 mile radius around the flight corridors and drill rig. Wildlife biologists believe that the elk would acclimate to the noise as long as it is confined to corridors (which is exactly the way it would be). In much the same way, wildlife often adjust to noise along limited access highways.

Surface Water.--Surface water effects are rated moderate to high for both the single-well road alternative and for field development. Sediment levels would greatly increase in Little Granite Creek during construction of the road and bridges. Once the bridges are in place, they would also act as constrictions and tend to alter hydraulic conditions in the creek. This would result in channel adjustments (scour in some stretches, deposition in others). The road itself might be subject to flooding. Loss of stream-side vegetation could affect water temperature and aquatic habitat.

Reconnaissance studies done for this EIS showed that Little Granite Creek contains an excellent cutthroat trout population. This is not a well known or highly used fishery nor is it in the same league with such streams as Granite Creek or the Hoback River. The effects on surface water, principally due to sediment, might affect the resident fish population in Little Granite Creek, but would not alter other downstream areas.

Surface water effects cannot be quantified at the present time without additional monitoring data. For these reasons Getty might be required to install and operate a stream gaging/monitoring station over the life of their project (see mitigating stipulations in chapter IV). Knowledge gained from the monitoring could be used to plan and evaluate future road construction in the area.

Vegetation.--Vegetation effects are rated high for both the single well Little Granite road access alternative and for field development. Little Granite Creek

currently provides winter range for moose, primarily because of the presence of willows and other riparian vegetation. Road construction would remove a wide swath (up to 30 to 35 feet) of this riparian zone. It was pointed out previously that this type of vegetation is difficult to re-establish because of its diversity. The road would also tend to cut off subsurface flow of water to riparian plants. In a broad valley the effects are minimal; however, in the narrow confines of Little Granite Creek, construction would produce major changes. The cumulative effects from field development would also be high. Revegetation of the upland country most of which is subalpine would be difficult--not impossible, but difficult. Long term use of the roads and compaction of the soils, over a 20 to 30 year period, would add to the problem. Soil nutrients would be lost or altered. Getty may be required to conduct revegetation studies if field development appears likely. The emphasis of such studies would be to develop techniques and materials suitable for the subalpine conditions present in the Bear Thrust Unit.

Wildlife.--Wildlife effects are rated moderate to high for field development. The studies conducted for this EIS show that the Bear Thrust Unit provides summer range for elk, moose, and bighorn sheep. It does not include key elk winter range or any calving areas. The long term presence of man over an area as large as the Little Granite structure would eventually affect all of these animals. They could be forced into surroundilng areas where competition for habitat might result in a modest population decline. Prolonged use of the Little Granite road would disrupt moose winter range for 20 to 30 years. Bighorn sheep are particularly sensitive to human intrusion and the populations would experience a minor decline, if experience elsewhere is any indicator.

The road system for field development would provide human accessibility to the heart of the southern Gros Ventre elk herds. This in turn would greatly increase the potential for harvest or hunter success. Rapid decline in the elk herds in the area would occur unless the State were to develop special management procedures. The ability to control people (i.e., hunters, hikers, RV enthusiasts, snowmobilers and the like) would be a critical factor in mitigating effects on wildlife. Forest Service and State wildlife biologists would monitor the situation closely and develop additional restrictions and/or special hunting regulations if necessary. As long as the Little Granite road remained as the only road into the high country, a guard could easily control people at a gate closure station. The Little Granite road and all of the trunk roads would be treated as private roads, and vehicle use would be limited to oil field or government personnel only.

Wilderness.--Wilderness effects are moderate to high for the single well road access alternative and high for field development. The road and drilling operation would clearly intrude the solitude and alter the undisturbed nature of the southern part of the recommended Gros Ventre Wilderness. The drill rig for the initial well would be visible to forest users over a several mile area although this might be mitigated to some extent by camouflage paint.

If exploration were unsuccessful, the road would be abandoned and rehabilitated. Persistent road scars would remain for many years in the last mile below the well site. Other stretches through the forested areas have a high likelihood of being returned to former conditions within 5 to 10 years.

Field development would render the area unsuitable for wilderness management until such time as oil/gas resources had been totally extracted and the area rehabilitated. Development of the Bear Thrust Unit would tend to open up the

southern end of the Gros Ventre Range to large scale intrusion by man unless the USGS and FS continue to restrict road access to as few main roads as possible. Disturbed areas would have to be re-evaluated at the time of abandonment to determine whether or not they might again be included in the Gros Ventre Wilderness and be managed for wilderness values. The primary road network and well pads would all lie in the upland country on benches and meadow lands along the Gros Ventre mountain front, if the analysis in this EIS is correct. This should make rehabilitation more feasible than if the terrain were all rugged canyons, for example. In the lower forested areas revegetation occurs quite rapidly (5 to 10 years). On the other hand no one is absolutely certain how quickly the subalpine terrain would respond.

Visual Effects.--Visual effects are rated moderate to high for field development. By itself, the Little Granite road would not greatly alter visual attributes of the Bear Thrust area. Field development, on the other hand, would require the construction of up to 12 miles of new roads in open terrain in the Bear Thrust Unit. National Forest lands along the Gros Ventre mountain front are recommended for visual retention. Visual resources would be compromised by field development, but the effects might be mitigated to some extent by rehabilitation, revegetation, and use of camouflage paint and materials. Recreational use of this area of the Gros Ventre is very low at present due to its remote location and the long hike (4 to 6 miles) necessary to reach the upper country. Visual alterations would be seen by very few people and so the sensitivity is much less than with Cache Creek (although several USGS-FS scientists might argue this point). The high alpine peaks which comprise the mountain front are spectacular by any standard, but they would be unscarred or unaffected by roads or construction/drilling activities.

CHAPTER VI

EVALUATION OF ALTERNATIVES

This chapter compares the alternatives for the Cache Creek and Bear Thrust Units. The alternatives are weighed against evaluation criteria developed by the USGS and the FS; these criteria represent the factors which the two bureaus feel are most important.

The following symbols indicate how well the alternatives satisfy the evaluation criteria:

fully - ●

partially - ◒

not at all - ○

The USGS-FS tried several methods for summarizing the impacts of the various alternatives in this chapter--descriptive narratives and a points system (i.e., 1 = good, 10 = bad), for example. But the shaded circles seemed to present the simplest, clearest summation. Narrative descriptions would merely repeat what has already been stated throughout the EIS, and a points system can be misleading, because some factors are considered more important than others dependent upon who is doing the ratings.

Table VI-1.--Evaluation of alternatives for the Cache Creek Unit

Alternatives (criteria)	Cache Creek Road (single well)	Game Creek Road (single well)	Field development (Game Creek Route)
1. Determine the area's potential to contribute to the Nation's energy needs (i.e., inventory oil and gas potential by drilling).	●	●	●
2. Recognize the lease rights of NCRA, Getty, and other members of the Bear Thrust Unit.	●	●	●
3. Provide for visual quality objectives of the area as defined in the Cache Creek-Bear Thrust mapping evaluation.	◒ Partial reduction of visual qualities in the area; would not meet visual objectives during operation, but could meet visual objectives after complete rehabilitation.	◒ Similar to Cache Creek road, but easier to meet objectives during operation; could meet visual objectives after complete rehabilitation.	○ Retention and partial retention cannot be met during operation, but partial retention could be met after complete rehabilitation.
4. Protect water quality, aquatic habitat, and riparian zones, both onsite and in access corridors.	◒ 1.78 miles of new construction and upgrading in riparian zone.	● Least amount of road along riparian zone requiring new construction or upgrading.	◒ Up to 6 miles of new road construction in riparian zone; increased potential for spills.
5. Minimize adverse effects on wildlife habitat basically by recognizing diverse habitat needs and protecting big-game populations.	◒ One season of operations; road closures maintained; controls on hunting.	◒ Same.	○ 6 miles of roads and 7 wellsites within elk calving area; possibly mitigated to some extent by road closures and other controls.
6. Maintain traditional recreational use of Cache Creek drainage.	○ Major interference with traditional users of watershed for 12-18 months.	◒ Avoids lower portions of Cache Creek, but would interfere with users in middle and upper portions.	○ Would create major long-term interference to many current uses of the watershed.
7. Minimize man's intrusion to the recommended Gros Ventre Wilderness in the exercise of mineral exploration and development activities.	Not applicable.	Not applicable.	○ Results in 20-30 year intrusion to the recommended wilderness and major access to it.
8. Feasibility of reclaiming disturbed area to natural conditions at the cessation of activities.	●	●	◒ Would require many years for rehabilitation.
9. Minimize impacts to the community of Jackson (overload of community facilities, noise, hydrogen sulfide, and other safety factors).	○ Traffic in neighborhoods, noise, high potential for incidents between local residents and drilling personnel.	● Problems from previous alternative greatly reduced.	○ High impacts on noise, air quality, recreation, and community culture for 20-30 years.

Table VI-2.--Evaluation of alternatives for the Bear Thrust Unit

Alternatives (criteria)	Little Granite Creek Road (single well)	Helicopter option (single well)	Field development (Little Granite Route)
1. Determine the area's potential to contribute to the Nation's energy needs (i.e., inventory oil and gas potential by drilling).	●	●	●
2. Recognize the lease rights of NCRA, Getty, and other members of the Bear Thrust Unit.	●	●	●
3. Provide for visual quality objectives of the area as defined in the Cache Creek-Bear Thrust mapping evaluation.	◒ Would not meet visual quality objectives during operation; partial retention could be met on most of road after complete rehabilitation; some sections will only meet maximum modification.	● Would not meet visual quality objectives during operation, but would after complete rehabilitation.	○ Would not meet visual quality objectives during operation; would meet modification after rehabilitation completed for most of the area; partial retention may be met for some rehabilitated areas.
4. Protect water quality, aquatic habitat, and riparian zones, both onsite and in access corridors.	◒ 4.0 miles of construction in riparian zone.	●	◒ Same access and same impacts as Little Granite Road for a single well.
5. Minimize adverse effects on wildlife habitat basically by recognizing diverse habitat needs and protecting big-game populations.	◒ One season of operations; road closure; controls on hunting.	◒ Restricting flights to two corridors would minimize impacts on wildlife; disturbance would last only 12-18 months.	◒ Intermittent use of 12 miles of road, mostly in elk summer range; maximum impact to sheep and minimal to moose; road closure and hunting control.
6. Maintain traditional recreational use of Cache Creek drainage.	Not applicable.	Not applicable.	Not applicable.
7. Minimize man's intrusion to the recommended Gros Ventre Wilderness in the exercise of mineral exploration and development activities.	◒ One season of operations 12-18 months; minimum of 5 years for restoration.	● Rehabilitation would minimize intrusion (about 10 acres of cleared drill pad).	○ Results in 20-30 year intrusion to the recommended wilderness and major access to it.
8. Feasibility of reclaiming disturbed area to natural conditions at the cessation of activities.	◒ Upper portions of road (last 1.5 miles) difficult to rehabilitate.	● Should be easy to reclaim.	◒ Difficulty in rehabilitating uplands because of the long-term disturbance and subalpine conditions.
9. Minimize impacts to the community of Jackson (overload of community facilities, noise, hydrogen sulfide, and other safety factors).	● Current drilling in the Granite Creek drainage has had no measureable effects on the Jackson community.	● Same as for Little Granite Creek Road alternative.	● Field development would involve small permanent work force and increase demand for community services to some extent.

Disapproval Considerations

Disapproval of an initial well in the Cache Creek Unit would not meet two major criteria: 1) that of determining the area's potential to contribute to the Nation's energy needs, and 2) that of recognizing the lease rights of NCRA. In addition, if field development were to involve areas within the wilderness, disapproval would not meet the intent of Section (4)(d)(3) of the Wilderness Act of 1964. Criteria number 7 (table VI-1) reflects the interpretation by the USGS-FS that Section (4)(d)(3) of the 1964 Act allows exploration for oil and gas in wilderness areas administered by the FS. The Gros Ventre Wilderness was studied under RARE II and recommended for inclusion into the Wilderness System. It is currently managed as a de facto wilderness area: provisions of the 1964 Act should therefore apply.

Disapproval consideration for Getty's APD in the Bear Thrust Unit would also fail to meet criteria numbers 1, 2, and 7 (table VI-2).

CHAPTER VII

IDENTIFICATION OF THE PREFERRED ALTERNATIVE(S)

Introduction.--The USGS and FS have thoroughly analyzed several possible alternatives in this EIS, to help them decide what to do about two APD's. This section of the EIS presents the two bureaus' preferred course of action. The actual decisions will be executed by the USGS and FS after the final EIS is filed with EPA, probably during the period October through December 1981. Legally, the Secretary of the Interior or his representative (i.e., the Director of the USGS) has been granted approval authority for APD's by virtue of provisions in the Mineral Leasing Act of 1920 and 30 CFR 221. The Secretary of Agriculture or his representative (i.e., the Regional Forester) can concur or disagree but is not empowered to alter decisions on APD's made by the Secretary of the Interior.

The Cache Creek-Bear Thrust EIS has been used to lay out and describe the environmental consequences of various alternatives. The EIS document will assist in decisionmaking but does not obligate the Secretary of the Interior (and/or Agriculture) to any particular course of action.

Cache Creek Unit.--The USGS-FS analysis in chapter VI of this EIS illustrates that the drilling of one well, using the Game Creek route, fully or partially meets all of the USGS-FS evaluation criteria. At the same time, the two bureaus conclude that development of an oil/gas field in the Cache Creek watershed could produce long term significant adverse impacts on many valued resources. The probability of success for exploratory, wildcat drilling is very low, approximately 5 percent. And the analysis of full field development must be viewed in proper context. The analysis of field development is highly speculative and would remain so until any potential oil and gas resources have been inventoried by drilling.

A limited approval option satisfies many USGS-FS objectives. That is, approval could be limited to the initial APD only, with the understanding that the government might pursue a disapproval option subsequent to the drilling of the first test well. Two additional alternative approaches are to 1) grant unqualified approval to the initial APD, with the understanding that full field development would also be approved, and 2) immediately pursue a disapproval option and attempt to close out all drilling in the Cache Creek Unit by seeking Congressional action. Compensation to NCRA, either in the form of an outright payment or lease exchange would necessarily be involved with any disapproval option, and this would have to be an integral part of any Congressional action.

Several legal aspects analyzed by the U.S. Department of the Interior Regional Solicitor's Office in Denver have a bearing on these matters. The Regional Solicitor advises that an oil and gas lease granted under the Mineral Leasing Act conveys a property interest enforceable against the United States. It cannot be canceled at the whim of the Secretary. It can only be canceled if the lessee breaches one of the terms of the lease or if the lessee agrees to the lease cancellation. Such a lease may, for certain specified reasons, be suspended temporarily by the Secretary so as to prevent any work thereon. In granting such suspensions, however, the Secretary may not rely on facts which are unlikely to change in the reasonably near future. Such a suspension would amount to a cancellation and such a cancellation is not authorized by law. During a temporary

suspension, the Secretary can 1) attempt to mitigate development concerns, or 2) initiate Congressional action to cancel the leases.

The statutory and regulatory scheme pursuant to which the leases involved in this EIS were issued does not authorize the Secretary to cancel them for reasons relating to the impact of development upon the environment. The Secretary may only impose reasonable conditons or stipulations designed to prevent unnecessary or undue degradation of the environment. Accordingly, if the Secretary concludes that it is in the public interest not to develop all or part of the leases in question, he must seek authority from Congress to cancel them.

The Secretary clearly has authority to suspend leases while seeking authority to cancel them, and to obtain an appropriation in an amount necessary to compensate the lessees for their leases. It is likely that any such suspension would be of relatively short duration. If Congress failed to act on such a request before adjourning the 2-year session during which it was introduced, it could be concluded, in the absence of extenuating circumstances, the Congress was unwilling to grant the requisite authority and funds.

In the absence of Congressional authority to cancel the leases, the APD's which have been filed in connection with the leases involved in this EIS would be approved within a reasonable period of time subject to reasonable stipulations designed to prevent unnecessary or undue degradation of the environment.

The USGS-FS favor a limited approval approach (i.e., allow NCRA to drill one well and then reevaluate the situation). This type of approach is routinely applied to most oil and gas APD's. However, in the case of Cache Creek, detailed (or as detailed as possible) analysis of projected field development impacts has been performed by the USGS-FS. This additional analysis may have the effect of creating an atmosphere of optimism or pessimism in the minds of the proponents or opponents as to the outcome of the project.

The Game Creek route has many environmental advantages over the Cache Creek route proposed by NCRA. Estimated construction and reclamation costs for the Game Creek access ($935,000) are not significantly greater than costs for the Cache Creek route ($720,000). The difference in cost for constructing and reclaiming the two routes ($215,000) is a small amount of money relative to the total cost of drilling the proposed exploratory well in the Cache Creek Unit (which will amount to several million dollars). The $215,000 difference also does not include unknown costs for upgrading or repair of Jackson city streets, if the Cache Creek route were utilized. The Game Creek route could serve as long-term access to a developing well field; the Cache Creek route could not. A requirement for NCRA to use the Game Creek route over the Cache Creek route therefore seems reasonable to the USGS-FS and is recommended by both bureaus.

Bear Thrust Unit.--Getty's proposed wellsite lies within the recommended Gros Ventre Wilderness, which was recommended to Congress for inclusion into the wilderness system as a result of the RARE II program. The areas encompassed by the proposed wellsite and access road are currently managed as wilderness. The USGS-FS believe that after any oil/gas reserves were depleted (20 to 30 years) the effects of Getty's drilling on wilderness values and visual resources could be reduced with proper rehabilitation. The current undisturbed, remote, roadless character of the area would be altered, but it would affect very few people and generally avoid key wildlife habitat. Proper management of personnel involved

with field development would mitigate or minimize most adverse impacts. After extraction of any oil/gas and rehabilitation, the area could again be managed as wilderness.

The Gros Ventre area has been managed as "de facto" wilderness for many years because of its unique scenic and wildlife attributes. Efforts were made to include this area into the Wilderness System after passage of the Wilderness Act of 1964, and prior to RARE I. During RARE I, the area was designated as Chief's Study Area No. 382 for possible inclusion into the Wilderness System. There were minimum conflicts between uses and users within the RARE I area. The FS recommended to the BLM that leases not be issued within this RARE I area until a wilderness decision was reached. The area was again studied under RARE II, and the wilderness boundaries were expanded from that studied under RARE I. Much of the acreage added in RARE II was encumbered by existing Federal oil and gas leases, whereas areas within the RARE I boundary had not been leased and rights conveyed to private companies. The Getty wellsite and the Bear Thrust Unit lie within this acreage added to the recommended Gros Ventre Wilderness as a result of RARE II.

Wilderness designation or recognition of an area has carried with it certain management direction. Every attempt has been made in the case of the recommended Gros Ventre Wilderness to limit surface disturbing impacts. If there is to be continued recognition of wilderness attributes, then there must be continued specialized management. The debate over roads versus no roads lies at the heart of many peoples' wilderness concerns. In addition, the question always arises, "Should a roadless area managed as wilderness be committed to wilderness before the area's mineral potential has been clearly established?"

Two alternatives for Getty's APD request were studied by the USGS-FS because of the wilderness management question: roading via Little Granite Creek and helicopter mobilization for the initial exploration well. The use of a road to accomplish proposed drilling in the Bear Thrust Unit is the conventional approach, and is clearly preferred by Getty. The most significant problems involve construction impacts on Little Granite Creek, reclamation of the road, and road scars which would persist as visual intrusions for many years.

Helicopter mobilization of oil and gas drilling would satisfy the intent of Section 4(d)(3) of the Wilderness Act of 1964 and allow Getty to exercise their drilling rights. It could accomplish exploration and initial inventory of the oil and gas resources with the least surface disturbance or disruption. Disturbed areas could be rehabilitated within a very short time because of the small acreage involved. (Development or extraction of resources is clearly another story, as roads would be required for access, pipelines, etc. The Wilderness Act and FS wilderness allocation process would allow for this contingency.)

Helicopter-assisted drilling is complicated, more expensive, and, as yet, untried in the lower 48 States. The helicopter option may be technically feasible if an onsite ground-water supply could be obtained to sustain drilling and camp operations. The potential financial impact to Getty could be very significant. Costs for drilling the well via helicopter mobilization (provided the onsite water source could be obtained) might range from 15 to 50 percent higher than for convential drilling. This would depend on weather, geologic conditions, and other unknown engineering factors.

The helicopter mobilization alternative fully satisfies practically all of the evaluation criteria. On the other hand, while the road alternative may not fully satisfy as many criteria, it does fully or partially meet all of the USGS-FS objectives. It appears that with proper reclamation using techniques currently available there would be no long-term effects from the Little Granite road other than persistent road scars in the last mile below the wellsite. Reclamation of the road, in the event of a dry hole, would be expensive and involve significant effort, but appears to be something that could be fully accomplished except for the last mile.

The USGS-FS recommend use of the Little Granite Creek road access alternative for Getty's APD request. The technical and cost factors of this option are clearly understood. It is economically feasible and practical, and fully or partially meets all environmental criteria detailed in chapter VI of this EIS.

CHAPTER VIII

CONSULTATION WITH OTHERS

The Cache Creek-Bear Thrust EIS has generated a great deal of public interest. Public participation on the Cache Creek-Bear Thrust proposal formally began in May 1980 with the mailing of a Preliminary Scoping Statement which explained the purpose, objectives, concepts, and tentative schedule of the study, and requested additional comments on the study area proposal.

To place this EIS in proper historic context, some background must be given as to what occurred prior to mailing the scoping document. After NCRA filed an APD for exploratory drilling in the Cache Creek Unit in 1977, the FS completed an environmental analysis report (EAR) in December 1977. Many written comments were received during this period (around 200) and were considered before issuing the EAR. A formal public meeting, involving both the USGS and the FS, was held in Jackson, Wyoming, on January 16, 1978. The FS recommendation, announced at this meeting for the first time, was that the USGS should prepare an EIS before approving NCRA's APD. Following this recommendation, the USGS completed an environmental analysis (EA) in June 1979 and conducted an additional public hearing in Jackson. The decision to prepare an EIS was then made in January 1980 by the Director of the USGS; in March 1980, the USGS and FS met to develop a memorandum of understanding and agreed to prepare jointly the Cache Creek EIS. The scope of the document was later enlarged to encompass the 1979 proposal by Getty Oil to conduct exploratory drilling operations within the nearby Bear Thrust Unit.

Public involvement has been thorough and ongoing throughout the environmental analysis process. A description of the various techniques used to involve the public follows.

Information mailing

The scoping document (which included a request for public comment), was mailed in May 1980 to over 300 individuals, organizations, agencies, previous respondents, and other interested parties. All lessees of record within the study area were also notified of the preparation of the EIS (35 companies and/or individuals who control the approximately 100 Federal oil and gas leases within this general area).

A Notice of Intent to prepare an EIS and schedule of public meetings appeared in the Federal Register, v. 45, No. 97, p. 32434, May 16, 1980; a similar notice was sent to the Planning Coordinator for the State of Wyoming Clearinghouse in June 1980 in compliance with OMB, A-95 Notification.

Meetings

A formal scoping meeting was held in Jackson, Wyoming, on June 17, 1980. Its purpose was twofold:

1) to review and clarify major issues and concerns already identified by the USGS and FS; and

2) to receive additional statements from the general public.

The scoping process was augmented by conducting public hikes to each of the proposed wellsites--NCRA's Cache Creek site on June 16, 1980, and Getty's site at the head of Little Granite Creek on June 18, 1980.

Over 160 people attended the public meeting, and some 35 individuals participated in the "show-me" trips to the proposed wellsite.

Media

The USGS and FS issued several news releases announcing the availability of the scoping document, and schedules regarding meetings and on-the-ground project review trips. Events related to the proposed drilling operations, as well as notices of meetings and trips, have received coverage from the two local newspapers in Jackson, and those located in Rock Springs, Lander, and Casper, Wyoming, and in Denver, Colorado. Two Jackson radio stations have also helped keep the public informed. Several journals have followed the project since the EIS was commenced by the USGS and FS in 1980.

Personal contacts

Personal contacts with concerned individuals were made by the task force leaders and other members of the USGS and FS throughout the analysis period. These personal contacts, and other informal meetings, were extremely important in developing an understanding of the various publics' positions. Information on technical aspects was sought by project scientists from many private firms and individuals. All such information has been used to assess the issues and concerns, public needs, demands, and alternative formulation.

Mr. William L. Johnson and other members of the Minerals Area Management staff (FS, Intermountain Region, Ogden) were particularly helpful in providing technical advice throughout preparation of the EIS.

The Wyoming Game and Fish Department participated in the development of the DEIS and the Fish and Wildlife Service was consulted regarding threatened and endangered species in the study area.

The Congressional Delegation for Wyoming has been updated on a continuing basis, and State Office Directors for the delegation members have been in contact with the USGS-FS throughout the analysis.

Written comments

The number of responses received prior to issuance of this DEIS precludes printing each letter and discussing each comment in detail. Many of the original written comments were compiled by the FS and published in the EAR; they were also reconsidered by the consultant retained by the USGS-FS to analyze socio-economic factors.

The public, private industry, and others were informed and involved in accordance with NEPA regulations. Written and verbal statements were used to identify issues, develop criteria, design alternatives, and, finally, will be used to select alternatives.

Distribution of this DEIS will be made to the following Federal, State, and local representatives, organizations, and agencies. These groups will be invited to submit review comments. Individuals who have previously indicated a desire to review the document will also receive a copy of the DEIS. The FEIS will include a complete list of all parties submitting written comments on the DEIS.

Copies of the DEIS, together with supplementary project reports, will be available for review at public libraries located in Jackson, Casper, Rock Springs, and Cheyenne, Wyoming. Bureau libraries located in Reston, Virginia, and Denver, Colorado for the USGS, and in Beltsville, Maryland for the FS will also serve as repository locations for review of these supplementary documents.

Federal government agencies

Department of Agriculture:
- Agriculture Marketing Service
- Agriculture Research Service
- Agriculture Stabilization and Conservation Service
- Animal and Plant Health Inspection Service
- Economics, Statistics and Cooperatives Service
- Farmers Home Administration
- Forest Service
- Management Analysis and Services
- Office of Environmental Quality
- Office of Equal Opportunity
- Science and Education Administration
- Soil Conservation Service

Department of Interior:
- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Mines
- Bureau of Reclamation
- Geological Survey
- National Park Service
- Office of Surface Mining
- U.S. Fish and Wildlife Service

Advisory Council on Historic Preservation
Civil Aeronautics Board
Department of Commerce:
- Economic Development Administration

Department of Defense
Department of Education
Department of Energy:
- Federal Energy Regulatory Commission

Environmental Protection Agency, Region VIII
Department of Health and Human Services
Department of Housing and Urban Development
Department of Justice:
- Land and Natural Resources Division

Department of Labor:
- Mine Safety and Health Administration

Department of State:
- Office of Environmental Affairs

Department of Transportation:

Federal Aviation Administration, Rocky Mountain Region
Federal Highway Administration, Region VIII
Federal Railroad Administration
Department of Treasury
Federal Trade Commission
U.S. Water Resources Council

Congressional delegation

Senator Alan K. Simpson
Senator Malcolm Wallop
Representative Richard Cheney
State Offices in Wyoming for Congressional Delegation

State of Wyoming

Governor of Wyoming
Wyoming State Clearinghouse:
includes all State agencies
Department of Environmental Quality:
Air Quality Division
Land Quality Division
Water Quality Division
Industrial Siting Council
State Representative H. L. Jensen, Teton County
State Senator John Turner, Teton-Sublette Counties

Local agencies

Board of County Commissioners, Teton County
Mayor, Town of Jackson
Teton County Planning Commission
Town of Jackson Planning Board
Teton County Association of Soil Conservation Districts
Jackson Hole Area Chamber of Commerce

National organizations

American Petroleum Institute
Audubon Society
Fly Fisherman's Federation
Friends of the Earth
Izaak Walton League
Sierra Club
National Wildlife Federation
Wildlife Management Institute
Wilderness Society

Regional, State, and local organizations

Mountain States Legal Foundation
Wyoming Geological Association
Petroleum Association of Wyoming
Rocky Mountain Oil and Gas Association

Old West Regional Commission
Idaho Environmental Council
Wyoming Outfitter's Association
Wyoming Cattlemen's Association
Wyoming District Forester
Wyoming Stockgrower's Association
Wyoming Timber Association
Wyoming Mountain Men Trails Foundation
Wyoming Outdoor Council
Wyoming Wilderness Association
Wyoming Wildlife Federation
Wyoming Mining Association
Jackson Hole Alliance for Responsible Planning
Jackson Hole Outfitters Association
Jackson Hole Cattle and Horse Association
Bridger-Teton National Forest Grazing Advisory Board
Teton County League of Women Voters
Jackpine Summer Homeowners
Jackson Hole Competitive Trail Ride Association
Jackson Hole Snow Devels
Building and Trades Association

Applicants and leaseholders

National Cooperative Refinery Association (NCRA)
Getty Oil Company
Mountain Fuel Supply Company
Rainbow Resources, Inc.
Barber Oil and Exploration Company, Inc.
Terra Resources, Inc.
Pacific Transmission Supply Company (Natural Gas Corporation of California)
Kerr-McGee Corporation
Mesa Petroleum Company
Empire Resources, Inc.
Tenneco Oil Company
Reading and Bates Petroleum Company
Northwest Exploration Company
Martin Exploration
Forest Oil Corporation
Placid Oil Company
C. F. True
Chevron USA, Inc.
Atlantic Richfield Company
Exxon Corporation
The Superior Oil Company
John M. Beard and Don H. Leeman
Carl W. Klaenhammer
W. H. Simmons
Dr. Thomas J. Florence
Joe F. Key
John J. Christmann
A. G. Hill
Thomas H. Connelly
William C. Kirkwood

A. G. Andrikopoulous
Claire E. Sullivan
Mr. O. Foster

CHAPTER IX

REFERENCES CITED

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Dorr, J. S., Jr., Spearing, D. A., and Steidtmann, 1977, Deformation and deposition between a foreland uplift and an impinging thrust belt: Hoback Basin, Wyoming: Geological Society of America Special Paper 177, 82 p.

Love, J. D., 1956, Geologic history of Teton County during Late Cretaceous, Tertiary, and Quaternary, in Wyoming Geological Association Guidebook, 11th Annual Field Conference, 1956: p. 140-150.

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Love, J. D., Keefer, W. R., Duncan, D. C., Bergquist, H. R., and Hose, R. K., 1951, Geologic map of the Spread Creek-Gros Ventre River area, Teton County, Wyoming: U.S. Geological Survey Oil and Gas Investigations Map OM-118, 2 sheets.

Love, J. D., and Love, C. M., 1978, Geologic map of the Cache Creek quadrangle, Teton County, Wyoming: U.S. Geological Survey Open-File Report 78-480, scale 1:24,000.

U.S. Forest Service, 1979, Roadless area review and evaluation two (RARE II): final environmental statement.

U.S. Geological Survey, 1979, Unusual environmental analysis (Cahce Creek): Application for permit to drill, National Cooperative Refinery Association, operator: Rock Springs, Wyoming, 104 p.

APPENDIX A

Memorandum of Understanding
between the
United States Geological Survey of the
Department of the Interior and the
United States Forest Service of the
Department of Agriculture

The purpose of the Memorandum of Understanding is to establish the basis for the preparation of a joint environmental impact statement (EIS), as prescribed by the National Environmental Policy Act of 1969 (Public Law 91-190), 42 U.S.C. 4321 et seq., Executive Order No. 11514 (35 CFR 4247), 40 CFR 1500-1508, and applicable Agency regulations for exploratory oil and gas drilling in the vicinity of Cache Creek, Bridger-Teton National Forest, Wyoming. The proposed oil and gas drilling would have significant impact upon the quality of the human environment and involves major Federal actions.

WHEREAS, the Director of the Geological Survey (USGS) has the authority to administer leases for Federal minerals under the Mineral Leasing Acts; and

WHEREAS, the Regional Forester of the Forest Service (FS) has the authority to administer the surface resources of lands reserved from the public domain and acquired public lands of the National Forest System under the jurisdiction of the Forest Service:

IT IS MUTUALLY AGREED THAT:

1. The USGS and FS will work as joint lead Agencies to prepare an EIS for the proposed oil and gas drilling activities in the vicinity of Cache Creek.

    a. The EIS will identify issues, concerns, and alternatives and describe impacts, effects, and necessary mitigation measures for the proposed project alternatives, both onsite and offsite.

    b. Each Agency will be responsible for data collection and analysis and the preparation of text and illustrations in their respective areas of assigned responsibility. The Agencies will contribute to the development of all sections of the EIS, with the objective of minimizing the environmental impacts and effects of each part of the proposed exploration activities. Each Agency will provide leadership in specific areas as follows:

        1) Geological Survey. Description of the proposed action; geology; hydrology (ground water and surface water); petroleum engineering and drilling; oil and gas reserve analysis; air quality/meteorology; socioeconomics; and overall project coordination,

        2) Forest Service. Vegetation; wildlife (including coordination with U.S. Fish and Wildlife Service and Wyoming Department of Game and Fish); soils; land use planning; recreation; access road analysis

and reclamation; visual resources; cultural resources (including coordination of archeological clearances); and rights-of-way.

c. The EIS will be approved for publication by:

1) The Regional Forester of the Forest Service.

2) The Director of the United States Geological Survey and Assistant Secretary of the Interior for Policy, Budget, and Administration.

2. Each Agency will designate a joint EIS task force leader and appropriate task force members. The EIS task force will prepare operating documents for the following matters:

a. Detailing of each participating Agency's area of responsibility and interface.

b. Coordination of effort, involvement of resource specialists, and review and approval procedures for both draft and final EIS's.

c. Definition of the sources of project funding and accounting.

d. Format and scope of the EIS.

e. Schedule for preparation and completion of the EIS.

3. The USGS will act as the coordinator of the EIS effort and will be responsible for incorporating the product of each Agency into the draft and final EIS's and their publication, including necessary Federal Register notices.

4. The USGS and FS will cooperate in public meetings to assure the dissemination of factual information.

a. FS will be responsible for organizing any local public meetings (Jackson, Wyoming) of an informational nature, USGS personnel will jointly participate.

b. USGS will be responsible for organizing any other informational public meetings outside Jackson, Wyoming. FS personnel will jointly participate.

c. If an "on-the-record" public hearing is required, USGS and FS will make available persons capable of providing expert testimony.

5. It is understood that work on the EIS will receive appropriate attention, except as limited by availability of funds and resources. Each participating Agency will fund its own activities and agrees to use its best efforts to complete the EIS by September 1981.

6. The USGS, as EIS coordinator with the assistance of FS, will contact the appropriate agencies of the State and counties of Wyoming to discuss the activities of the EIS task force.

7. The USGS and FS mutually agree to provide monthly progress reports concerning status of their respective activities on the EIS and any items of special interest or requiring special coordination.

8. Formal communications with the public shall be coordinated with each respective USGS and FS task force leader.

9. The USGS and FS mutually agree to execute a decision document concerning pending oil and gas drilling activities addressed in the EIS within 90 days after completion of the final environmental impact statement.

10. Nothing in this agreement will be construed as limiting or affecting in any way the authority or legal responsibility of the Director of the U.S Geological Survey or the Regional Forester of the Forest Service, or as binding the USGS or the FS to perform beyond the respective authority of each, or to require either party to assume or expend any sum in excess of appropriations available.

11. The period of this agreement shall be from the date of execution until terminated by mutual agreement or on 30 days written notice from either party to the other.

(Signed) Jeff M. Sirmon	4-17-80
Acting Regional Forester, Intermountain Region, U.S. Forest Service	Date

(Signed) George H. Davis	4-14-80
for Director, U.S. Geological Survey	

APPENDIX B

(F.R. Doc. 47-8091; Filed, Aug. 29, 1947; 8:47 a.m.) (Fed. Reg. - p. 5860)
Office of the Secretary
Jackson Hole, Wyoming, Area

MEMORANDUM REGARDING OIL AND GAS LEASES

Memorandum to: the Director, Bureau of Land Management, and the Director, Geological Survey, from: The Secretary of the Interior.

After conferring with proponents and opponents of oil and gas development in the Jackson Hole area of northwestern Wyoming, I have concluded that unit plans may be approved, oil and gas leases issued, and drilling authorized on lands in the Teton National Forest south of the 11th Standard Parallel, exclusive of lands lying within the Teton Wilderness Area south of said parallel, subject to the following conditions:

1) No unit plan will be approved unless the Geological Survey reports that the structural conditions are such as to warrant the belief that the lands included therein may contain oil or gas. Prior to such approval copies of the proposed unit plan will be submitted to all interested agencies of this Department, as well as to the Forest Service, Department of Agriculture, for recommendations as to stipulations or conditions which it is felt should be incorporated into that plan.

2) Prospecting and development under an approved unit plan shall not be permitted until all lands within the area are made subject to the unit plan unless a determination shall be made by the Secretary or his representative that the unit operator has made every reasonable effort to unitize all lands and the uncommitted land is insufficient in amount or so located that the orderly development of the unit area will not be adversely affected. If any part of the geological structure is located on Federal lands which are within the Jackson Hole National Monument, the Teton Wilderness Area, or which are otherwise unavailable for leasing, a unit plan for the remaining available acreage on the structure will not be approved unless the Geological Survey reports that oil or gas development, limited to the available lands, is in the best interests of the United States.

3) All leases shall provide that no drilling will be authorized except under an approved unit plan.

4) All leases and all unit plans for lands within the area must contain a provision vesting in the Secretary of the Interior or his duly authorized representatives, control over the rate of prospecting and development, including, in particular, the spacing of wells and such other conditions as may be deemed necessary in any case for the protection of the wildlife or scenic values within the area.

The lands north of the area defined herein shall continue to be temporarily withheld from leasing under the oil and gas provisions of the Mineral Leasing Act, unless the lands in T. 45 N., R. 113 W., 6th P.M., Wyoming, outside the Jackson Hole National Monument and outside the Teton Wilderness Area, are deemed necessary to establish or complete a logical unit area.

J. A. Krug

August 15, 1947

Secretary of the Interior

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

JACKSON HOLE AREA OIL AND GAS LEASE STIPULATION

The lands embraced in this lease being within the area designated in the memorandum of August 15, 1947, by the Secretary of the Interior ("Oil and Gas Leases in the Jackson Hole, Wyoming, Area"; Federal Register, August 30, 1947, page 5859), which specifies the general condition under which the unitized development of the oil and gas resources is authorized, the lessee hereby agrees:

1) To drill only such wells on the leased land as may be authorized by the Secretary of the Interior under an approved unit plan; to drill no well within 1,250 feet of any public road on or adjacent to the leased land without the consent of the Secretary of the Interior first had and obtained; to refrain from defacing, injuring, or destroying trees, shrubs, or natural features, or removing same outside of the authorized work limits or pipeline and road rights-of-way as established pursuant to, or revised in accordance with, the unit plan. After designation of the authorized work limits by the Secretary of the Interior or his representatives, lessee shall mark such limits by some acceptable visual means. The location of camps, storage, parking of equipment, and storage of materials shall be confined within the authorized work limits. Sludge or other waste by-products from drilling or operations shall be so confined or disposed of that they do not destroy scenic values or wildlife or pollute streams.

2) To remove at the termination of drilling operations, all camps and buildings not essential to a continuing operation of any well, and to fill all sump holes, ditches, and other excavations, remove or cover all debris, and to restore the sites to a neat and presentable condition appropriate to the surrounding landscape, and, upon partial or total relinquishment, cancellation or expiration of this lease as to that part of the leased land to which his rights have terminated, so far as reasonably possible, to restore the surface of the leased land to its former condition to the extent deemed necessary by the Secretary of the Interior and the Regional Forester, U.S. Forest Service, Ogden, Utah, or their authorized representatives.

3) To keep to an absolute minimum the number of access, tote roads and other travelways necessary to conduct to lessee's operations, the location of which shall be designated by the Supervisor prior to the time of their construction. Access to existing public highways shall be determined by the Supervisor at such points on the highways with due regard for sight distance restrictions, safety, or scenic considerations. The location, alignment and cross-section of all roads constructed for the convenience of lessee's operations, shall be such that after discontinuance of use, they can be obliterated and the area over which they traverse can be restored to its original condition. All types of roads constructed for operation uses shall, at the termination of these uses be obliterated where required and the area over which they traversed restored in such a manner that revegetation will be encouraged. All roads constructed for operational purposes are to be

considered as private roads and the erection of signs, locked gates, or other devices that may be required, at the discretion of the Supervisor, to discourage or prevent their use by the public shall be constructed and maintained by the lessee.

4) To protect the scenic and aesthetic values of roadsides, waterfronts, and recreation area zones as far as possible consistent with the authorized use in connection with construction, operation and maintenance facilities.

5) To conduct operations in a manner that will offer the least possible disturbance to wildlife on or adjacent to the leased land; to exercise no methods of control or interference with such wildlife without authority first obtained from the authorized representative of the Secretary of the Interior and/or the State Game and Fish Commission; to make no claim against the Government or the State on account of damage by such wildlife to improvements placed on the leased land.

6) To observe and comply with all State and Federal laws and regulations relating to wildlife and to take such action as is necessary to assure observation and compliance with these laws and regulations by lessee's employees and agents.

As to any land within the Cache Creek Municipal Watershed, the lease will contain the following additional stipulation:

7) To comply with plans heretofore made through agreement with the Forest Service and the Town Council of Jackson, Wyoming, for the protection from pollution of the municipal water during the term of this lease or any extension thereof.

Form 3109–3
(June 1971)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

STIPULATION FOR LANDS UNDER JURISDICTION OF DEPARTMENT OF AGRICULTURE*

The lands embraced in this lease or permit being under the jurisdiction of the Secretary of Agriculture, the lessee or permittee hereby agrees:

(1) To conduct all operations authorized by this lease or permit with due regard for good land management, not to cut or destroy timber without first obtaining permission from the authorized representative of the Secretary of Agriculture, and to pay for all such timber cut or destroyed at the rates prescribed by such representative; to avoid unnecessary damage to improvements, timber, crops, or other cover; unless otherwise authorized by the Secretary of Agriculture, not to drill any well, carry on operations, make excavations, construct tunnels, drill, or otherwise disturb the surface of the lands within 200 feet of any building standing on the lands and whenever required, in writing, by the authorized representative of the Secretary of Agriculture to fence or fill all sump holes, ditches, and other excavations, remove or cover all debris, and so far as reasonably possible, restore the surface of the lands to their former condition, including the removal of structures as and if required, and when required by such representative to bury all pipelines below plow depth.

(2) To do all in his power to prevent and suppress forest, brush, or grass fires on the lands and in their vicinity, and to require his employees, contractors, subcontractors, and employees of contractors or subcontractors to do likewise. Unless prevented by circumstances over which he has no control, the lessee or permittee shall place his employees, contractors, subcontractors, and employees of contractors and subcontractors employed on the lands at the disposal of any authorized officer of the Department of Agriculture for the purpose of fighting forest, brush, or grass fires on or originating on the lands or on adjacent areas or caused by the negligence of the lessee or permittee or his employees, contractors, subcontractors and employees of contractors and subcontractors, with the understanding that payment for such services shall be made at rates to be determined by the authorized representative of the Secretary of Agriculture, which rates shall not be less than the current rates of pay prevailing in the vicinity for services of a similar character: *Provided*, that if the lessee or permittee, his employees, contractors, subcontractors, or employees of contractors or subcontractors, caused or could have prevented the origin or spread of said fire or fires, no payment shall be made for services so rendered.

During periods of serious fire danger to forest, brush, or grass, as may be specified by the authorized representative of the Secretary of Agriculture, the lessee or permittee shall prohibit smoking and the building of camp and lunch fires by his employees, contractors, subcontractors, and employees of contractors or subcontractors within the area involved except at established camps, and shall enforce this prohibition by all means within his power: *Provided*, that the authorized representative of the Secretary of Agriculture may designate safe places where, after all inflammable material has been cleared away, campfires may be built for the purpose of heating lunches and where, at the option of the lessee or permittee, smoking may be permitted.

The lessee or permittee shall not burn rubbish, trash, or other inflammable materials *except* with the consent of the authorized representative of the Secretary of Agriculture and shall not use explosives in such a manner as to scatter inflammable materials on the surface of the lands during the forest, brush, or grass fire season, *except* as authorized to do so or on areas approved by such representative.

The lessee or permittee shall build or construct such fire lines or do such clearing on the lands as the authorized representative of the Secretary of Agriculture decides is essential for forest, brush, and grass fire prevention which is or may be necessitated by the

* This form of stipulation may be used in connection with leases and permits issued under the Acts of February 25, 1920, as amended (30 U.S.C. 181 *et seq.*); August 7, 1947 (30 U.S.C. 351 *et seq.*); February 7, 1927, as amended (30 U.S.C. 281 *et seq.*); April 17, 1926, as amended (30 U.S.C. 271 *et seq.*); June 28, 1944 (58 Stat. 483–485); September 1, 1949 (30 U.S.C. 192c); June 30, 1950 (16 U.S.C. 508b); or under the authority of any of the Acts cited in Section 402 of the President's Reorganization Plan No. 3 of 1946 (5 U.S.C. 133y–16, Note).

exercise of the privileges authorized by this lease or permit, and shall maintain such fire tools at his headquarters or at the appropriate location on the lands as are deemed necessary by such representative.

(3) In the location, design, construction, and maintenance of all authorized works, buildings, plants, waterways, roads, telegraph or telephone lines, pipelines, reservoirs, tanks, pumping stations, or other structures or clearance, the lessee or permittee shall do all things reasonably necessary to prevent or reduce to the fullest extent scarring and erosion of the lands, pollution of the water resources and any damage to the watershed. Where construction, operation, or maintenance of any of the facilities on or connected with this lease or permit causes damage to the watershed or pollution of the water resources, the lessee or permittee agrees to repair such damage and to take such corrective measures to prevent further pollution or damage to the watershed as are deemed necessary by the authorized representative of the Secretary of Agriculture.

(4) If in the opinion of the authorized representative of the Secretary of Agriculture, the lands are valuable for watershed protection, the lessee or permittee shall provide for control of surface runoff and return the affected area to as productive condition as practicable.

(5) To pay the lessor or permitter or his tenant or the surface owner or his tenant, as the case may be, for any and all damage to or destruction of property caused by the lessee's or permittee's operations hereunder; to save and hold the lessor or permitter or the surface owner or their tenants harmless from all damage or claims for damage to persons or property resulting from the lessee's or permittee's operations under this lease or permit.

(6) To recognize existing uses and commitments, in the form of Department of Agriculture grazing, timber cutting, and special use permits, water developments, ditch, road, trail, pipeline, telephone line, and fence rights-of-way and other similar improvements, and to conduct his operations so as to interfere as little as possible with the rights and privileges granted by these permits or with other existing uses.

(7) To install and maintain cattle guards to prevent the passage of livestock in any openings made in fences by the lessee or permittee or his contractors to provide access to the lands covered by this lease or permit for automotive and other equipment.

(8) If lessee or permittee shall construct any camp on the lands, such camp shall be located at a place approved by the authorized representative of the Secretary of Agriculture, and such representative shall have authority to require that such camp be kept in a neat and sanitary condition.

(9) To comply with all federally-approved rules and regulations of the Secretary of Health, Education, and Welfare governing the emission of pollutants into the air from activities which are embraced in this lease or permit.

(10) To comply with all the rules and regulations of the Secretary of Agriculture governing the national forests or other lands under his jurisdiction which are embraced in this lease or permit.

(11) Unless otherwise authorized, prior to the beginning of operations to appoint and maintain at all times during the term of this lease or permit a local agent upon whom may be served written orders or notices respecting matters contained in this stipulation, and to inform the authorized representative of the Secretary of Agriculture, in writing, of the name and address of such agent. If a substitute agent is appointed, the lessee or permittee shall immediately so inform the said representative.

(12) To address all matters relating to this stipulation to

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who is the authorized representative of the Secretary of Agriculture, or to such other representative as may from time to time, be designated, provided that such designation shall be in writing and be delivered to the lessee or permittee or his agent.

NOTE: NCRA lease W-20066 was issued with Form 3109-3 (October 1970) and Getty lease W-20472 included Form 3109-2 (October 1964). Both earlier versions of this stipulation have the same text except for rewording of section (4) of the example presented.

_____

(Signature of Lessee)

GPO 850-292

SPECIAL STIPULATION

The lessee will not undertake any drilling, construction of roads or pipelines, or any other activity which involves removal of vegetation until a plan of construction and development has been approved by the Forest Service representative. Such approval may be conditioned on reasonable requirements to prevent erosion, water pollution, or damage to surface resources and to provide for restoration of the surface.

Form 3500–1
(March 1967)
(formerly 4–1223)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

POWERSITE STIPULATION

The lessee or permittee hereby agrees:

(a) If any of the land covered by this lease or permit was, on the date the lease or permit application or offer was filed, within a powersite classification, reservation, or project on which an application for a license or preliminary permit is pending before the Federal Power Commission or on which an effective license or preliminary permit had been issued by the Federal Power Commission under the Federal Power Act, or on which an authorized power project (other than one owned or operated by the Federal Government) had been constructed, the United States, its permittees or licensees shall have the prior right to use such land for purposes of power development so applied for, licensed, permitted, or authorized and no compensation shall accrue to the mineral lessee or permittee for loss of prospective profits or for damages to improvements or workings, or for any additional expense caused the mineral lessee as a result of the taking of said land for power development purposes. It is agreed, however, that where the mineral lessee or permittee can make adjustments of his improvements to avoid undue interference with power development, he will be permitted to do so at his own expense. Furthermore, occupancy and use of the land by the mineral lessee or permittee shall be subject to such reasonable conditions with respect to the use of the land as may be prescribed by the Federal Power Commission for the protection of any improvements and workings constructed thereon for power development.

(b) If any of the land covered by this lease or permit is on the date of the lease or permit within a powersite classification or reservation which is not governed by the preceding paragraph, the lease or permit is subject to the express condition that operations under it shall be so conducted as not to interfere with the administration and use of the land for powersite purposes to a greater extent than may be determined by the Secretary of the Interior to be necessary for the most beneficial use of the land. In any case, it is agreed that where the mineral lessee or permittee can make adjustments to avoid undue interference with power development, he will be permitted to do so at his own expense.

GPO 833-827

SPECIAL WILDLIFE HABITAT STIPULATION

The lease area contains critical/key habitat for certain wildlife species. Of paramount concern on this lease area are: _____. Therefore, prior to entry onto the leasehold, the operator will jointly discuss the proposed activities with the Area Oil and Gas Supervisor or his representative, the Forest Supervisor or his representative, and the Wyoming Game and Fish Department. Additional measures may be required to protect the above species and habitat features; these include:

a) No surface occupancy of selected areas.

b) Restrictions on season of operation.

c) Special reclamation techniques and/or requirements.

d) Restrictions on rate of development and spacing and location of wells.

e) Special road closure requirements.

DEPARTMENT OF ENERGY STIPULATION

This lease is issued pursuant and subject, to the extent applicable, to the terms and provisions of Section 302 of the Department of Energy Organization Act (42 U.S.C. 7152) and to the regulations of the Secretary of Energy promulgated thereunder relating to the:

1) fostering of competition for Federal leases (including, but not limited to, prohibition on bidding for development rights by certain types of joint ventures);

2) implementation of alternative bidding systems authorized for the award of Federal leases;

3) establishment of diligence requirements for operations conducted on Federal leases (including, but not limited to, procedures relating to the granting or ordering by the Secretary of the Interior of suspension of operations or production as they relate to such requirements);

4) setting rates of production for Federal leases; and

5) specifying the procedures, terms, and conditions for the acquisition and disposition of Federal royalty interests taken in kind.

APPENDIX C

PROJECT REPORTS AND REPOSITORY LOCATIONS

Project Reports Available for Inspection at Repository Locations and for Purchase through Open-File Services Section, U.S. Geological Survey, Denver, Colorado (80225)

Camenzind, F. J., 1980, Wildlife survey--Cache Creek and Little Granite Creek, Bridger-Teton National Forest: U.S. Geological Survey Open-File Report 81-851, 71 p. (1981).

Caraveo, C. F., and Lau, Steven, 1981, An archeological sample survey in the Cache Creek-Little Granite Creek area of the Bridger-Teton National Forest, western Wyoming: U.S. Geological Survey Open-File Report 81-852, 155 p. (1981).

Chen and Associates, 1980, Engineering geology investigation, Little Granite Creek road corridor, Teton National Forest, Teton County, Wyoming: U.S. Geological Survey Open-File Report 81-853, 24 p., 2 oversize sheets (1981).

_____1980, Engineering geology investigation, Game Creek-Cache Creek road corridor, Teton National Forest, Teton County, Wyoming: U.S. Geological Survey Open-File Report 81-854, 24 p., 2 oversize sheets (1981).

Craig, G. S., Ringen, B. H., and Cox, E. B., 1981, Hydrologic data for the Cache Creek-Bear Thrust environmental impact statement near Jackson, Wyoming: U.S. Geological Survey Open-File Report 81-410, 46 p.

Glenn, W. B., 1981, Soil resource inventory, order 3, Cache Creek-Little Granite Creek EIS area, Bridger-Teton National Forest: U.S. Geological Survey Open-File Report 81-855, 55 p.

Goetze, P. R., 1981, Regional geologic map for the Cache Creek-Bear Thrust environmental impact statement, Teton and Sublette Counties, Wyoming: U.S. Geological Survey Open-File Report 81-856, scale 1:48,000.

Holden, P. B., and Campbell, J. R., 1980, Fisheries resource evaluation, Cache Creek EIS: U.S. Geological Survey Open-File Report 81-857, 28 p. (1981).

Jorgensen, P. M., 1981, Identification of transportation route alternatives and engineering feasibility studies for Bridger-Teton National Forest, Cache Creek and Little Granite Creek EIS data gathering and evaluation: U.S. Geological Survey Open-File Report 81-858, 58 p.

Kruger, P. W., 1981, Report on climate, air quality and noise for the Cache Creek-Bear Thrust environment impact statement: U.S. Geological Survey Open-File Report 81-859, 78 p.

Rodriguez, R. G., and Luchetta, John, 1981, Helicopter mobilization of oil and gas drilling operations in mountainous areas of western Wyoming: U.S. Geological Survey Open-File Report 81-860, 117 p., plus appendices (92 p.).

Wirth Associates, 1980, Cache Creek EIS--Final recreation evaluation study: U.S. Geological Survey Open-File Report 81-861, v. 1, 68 p., 272 data sheets, 12 oversize sheets; v. 2, 366 data sheets (1981).

Wyoming Research Corporation, 1980, A socioeconomic assessment of the Cache Creek drilling site: U.S. Geological Survey Open-File Report 81-862, 130 p. (1981).

Youngblood, A. P., 1980, Vegetation analysis for the Cache Creek EIS, Bridger-Teton National Forest: U.S. Geological Survey Open-File Report 81-863, 32 p., 2 oversize sheets (1981).

Project Reports Available for Inspection Only at Repository Locations

Madsen, L. L., 1980, Legal Memorandum: nonapproval alternative of the Cache Creek EIS, dated October 10, 1980: Regional Solicitor's Office (Denver), 32 p.

U.S. Forest Service, 1980, Visual resource inventory for the Cache Creek-Bear Thrust EIS, Bridger-Teton National Forest: scale 1:24,000, 4 sheets.

U.S. Geological Survey, 1977, Cache Creek Unit Agreement No. 14-08-0001-16089: North Central Region, 32 p.

_____1979, Bear Thrust Unit Agreement No. 14-08-0001-18094: North Central Region, 73 p.

Repository Locations for Project Reports and for Draft Environmental Impact Statement

Locations in Wyoming:

Teton County Library
320 South King Street
Jackson, Wyoming
Phone: (307) 634-3561
Hours: Monday, Wednesday, Friday, 10:00 a.m. to 6:00 p.m.
Tuesday, Thursday, 10:00 a.m. to 9:00 p.m.
Sunday, 1:00 p.m. to 5:00 p.m.

U.S. Forest Service
340 North Cache Street
Jackson, Wyoming
Phone: (307) 733-2752
Hours: Monday through Friday, 7:45 a.m. to 4:30 p.m.

Rock Springs Public Library
400 C Street
Rock Springs, Wyoming
Phone: (307) 362-6212
Hours: Monday through Friday, 10:00 a.m. to 8:30 p.m.
Saturday, 1:00 p.m. to 6:00 p.m.

Laramie County Library
2800 Central Avenue
Cheyenne, Wyoming
Phone: (307) 634-3561
Hours: Monday through Thursday, 9:00 a.m. to 9:00 p.m.
Friday, 9:00 a.m. to 6:00 p.m.
Saturday, 10:00 p.m. to 6:00 p.m.
Sunday, 1:00 p.m. to 5:00 p.m.

Natrona County Library
Documents Department
Walcott and 2nd Streets
Casper, Wyoming
Phone: (307) 235-9272
Hours: Monday through Wednesday, 9:00 a.m. to 9:00 p.m.
Thursday through Saturday, 9:00 a.m. to 6:00 p.m.

Other Repository Locations:

U.S. Geological Survey Library
Denver West Building No. 3
1526 Cole Boulevard
Golden, Colorado
Phone: (303) 234-4133
Hours: Monday, Tuesday, Thursday, Friday, 7:30 a.m. to 4:00 p.m.

U.S. Geological Survey Library
National Center
12201 Sunrise Valley Drive
Reston, Virginia
Phone: (703) 860-6671
Hours: Monday through Friday, 7:45 a.m. to 4:15 p.m.

National Agriculture Library
U.S. Department of Agriculture
Science and Education Administration
NAL Building
10301 Baltimore Boulevard
Beltsville, Maryland
Phone: (301) 344-3355
Hours: Monday through Friday, 8:00 a.m. to 4:30 p.m.

APPENDIX D

MITIGATING MEASURES TO MINIMIZE SOIL DAMAGE ALONG ROAD CORRIDORS AND PAD LOCATIONS

GAME CREEK-CACHE CREEK ROUTE (See fig. app.-D-1.)

General Mitigating Measures

1. The planned design of a narrow road about 14 feet wide is one of the more significant mitigating measures to reduce soil disturbance.

2. Seeding and mulching of all disturbed areas, other than exposed bedrock, will stabilize those sites from erosion and reduce visual impacts. All slopes that are 1:1 or flatter will be seeded. Steeper slopes should only be designed for bedrock cuts where no revegetation is planned.

Station 0+00 to 163+00

The most significant problem to be mitigated along this road section that parallels Game Creek is to keep sediment from the road from entering the creek. In some places the creek is up to several hundred feet from the road and has a more than adequate vegetated buffer strip. In a number of other places the stream meanders very close to the road alignment and has an inadequate vegetated filter strip if runoff from the road is discharged on those areas. It appears that, in most cases, runoff from the road can be carried from sections with inadequate buffering to areas with wide buffer strips and discharged there. This will require on the ground design to specify the locations for sediment discharge.

Placement of fill into the creek channel should be avoided if at all possible. Any fill placed in the creek channel should be protected with riprap.

Station 163+00 to 177+90

The route crosses wet alluvium on Game Creek and parallels the edge of the wet bottomland. Disturbance to the wetland area can be avoided by building the road over a base of coarse rock placed on the alluvium. Drainage from the road should be carried away from stream channels and beaver ponds and discharged in vegetated buffer strips.

Station 177+90 to about 192+00

The road closely parallels a spring-fed stream in the bottom of a narrow, steep-sided drainage. It will be very difficult to avoid sedimentation of the spring-fed stream without piping the spring to Game Creek.

Placement of the road higher on the slope will increase cutting and filling and result in greater sediment production which will probably offset any increase in vegetated buffer width.

If the road is built on the toeslope near the stream, the drainage from the lower few hundred feet of the road could be carried down the road ditch and

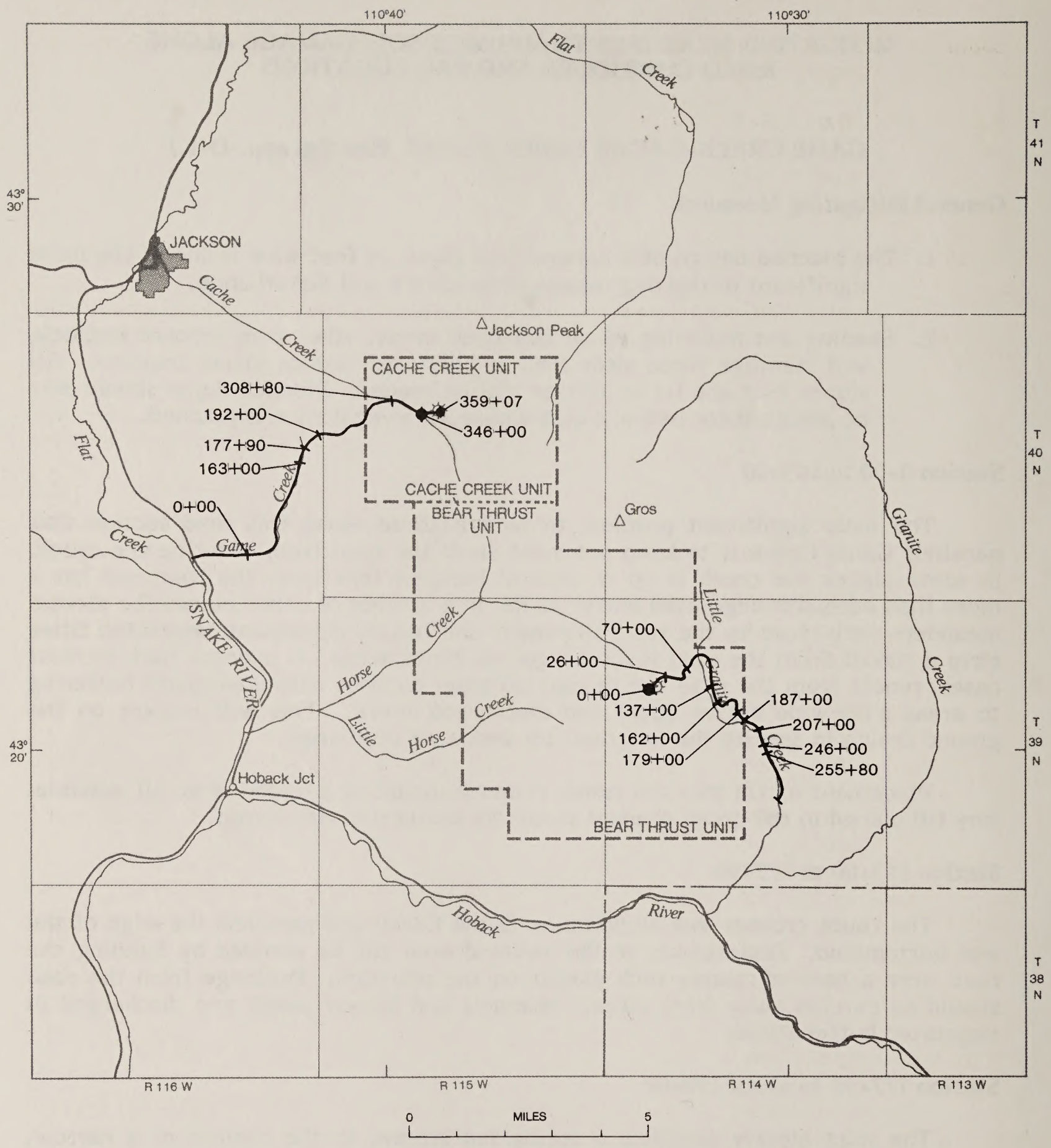

Figure App.-D-1.--Soils stipulations map showing specific mileage along proposed routes.

discharged on the Game Creek bottomland where a wider buffer occurs. Drainage from the upper part of this road section can be discharged on the wider parts of the minimal buffer that can be maintained along the stream. Small sediment basins could be used at culvert outlets if there is enough space for them. Sediment control will require specialized design in this area.

Station 192+00 to 308+80

No special mitigagion measures recommended. Normal road drainage will handle erosion.

Station 308+80 to 346+00

The most significant problem to be mitigated along this road section that parallels Cache Creek is to keep sediment from the road from entering Cache Creek.

In some places the creek is over 100 feet from the road and has an adequate vegetated buffer strip. In a number of other places the stream meanders against the road alignment and has no vegetated buffer strip.

In the places where the creek is now against the existing road that needs to be widened, at least two alternatives exist for mitigation of impacts by the road:

1. The road can be widened by end hauling the excavated material. Cutslope height and difficulty of revegetation will be increased by this alternative.

2. If the existing roadbed is to be widened toward to creek, large clean rock should be placed in the creek and a roadbed of finer material built on top of the rock base. Any constrictions or changes in the creek channel resulting from such construction will need to be looked at from a hydrologic point of view to determine the long-term effects on streambank erosion.

Runoff from the road should not be discharged on areas where there is no buffer or a very narrow buffer between the road and creek. The road drainage should be carried to areas where there is an adequate buffer along the creek. This will require on the ground design to place the cross drainage in the most suitable locations.

Approximately station 346+00

A small unstable spot occurs on the old roadbed. In order to keep fill from a reconstructed road from sliding into Cache Creek, the area that has slid out should be backfilled with large rock starting at the edge of the creek and continuing up to the level of the roadbed in order to buttress the unstable spot.

Station 346+00 to 359+07

No special mitigation measures recommended. Normal road drainage practices will handle erosion.

LITTLE GRANITE CREEK ROUTE (See fig. app.-D-1.)

Station 0+00 to 26+00

No special mitigating measures recommended. Normal road drainage practices will handle erosion.

Station 26+00 to 70+00

Road alignment crosses unstable area. Mitigating measures for reducing effects of the road on the unstable soils are:

1. Investigate feasibility of making minor adjustments in the road alignment to take advantage of gentle spots on the slope and reduce cutting and filling.

2. Provide drainage in wet spots.

3. Flatten cutslopes in wet spots.

4. Place rock buttresses on deep cuts in landslides.

Station 70+00 to 137+00

No specal mitigation measures recommended. Normal road drainage will handle erosion.

Station 137+00 to 162+00

A few wet spots and small pothole ponds located along this section should not be encroached upon.

Station 162+00 to 179+00

Intensive cross drainage will be needed to dissipate runoff from these two switchbacks.

Station 179+00 to 187+00

Road cross drainage should be placed so that it isn't discharged into stream channels that are adjacent to the road.

Station 187+00 to 207+00

Some spots of unstable soils occur along this section. Mitigating measures for reducing the effects of the road on the unstable soils are:

1. Align road on benchy parts of slope to reduce cutting and filling.

2. Provide drainage in wet spots, flatten cutslopes in moist unstable sopts.

3. Place rock buttresses on deep cuts in unstable spots.

Station 207+00 to 246+00

No special mitigation measures recommended. Normal road drainage will handle erosion.

Station 246+00 to 255+80

A series of small switchbacks will disturb a sizeable area on the slope just above Little Granite Creek. Intensive drainage will be needed on the road to handle runoff from the switchbacks, and a sediment basin may be needed between the switchbacks and the creek.

Station 255+80 to 308+88

The most significant problem to be mitigated along this long road section that parallels Little Granite Creek is to keep sediment from the road from entering the creek. In some places the creek is 100 feet or more from the road and has a more than adequate vegetated buffer strip. In a number of other places the stream meanders very close to the road alignment and has an inadequate vegetated filter strip if runoff from the road is discharged on these areas. It appears that, in most cases, runoff can be carried from sections with inadequate buffering to areas with wide buffer strips and discharged there. This will require on the ground design to specify the locations for sediment discharge.

Placement of fill into the creek channel should be avoided if at all possible. Any fill placed in the creek channel should be protected with riprap.

DRILL PADS (CACHE CREEK AND LITTLE GRANITE CREEK)

Stockpile at least 1 foot of topsoil for future reclamation.

APPENDIX E

WELL COST ESTIMATE: HELICOPTER MOBILIZATION

	ITEM	TANGIBLE COSTS	INTANGIBLE COSTS	HELICOPTER HOURS IN & OUT H= HEAVY LIFT
1.	BONDS & FEES		15,000	
2.	STAGING AREA: BUILD & RESTORE		45,000	
3.	UPGRADE ROAD TO STAGING AREA		30,000	
4.	WELL SITE: BUILD & RESTORE		175,000	6.0 H
5.	RIG MOBIL & DEMOBIL		320,000	68.5
6.	CASING HEAD/TREE	10,000		0.5
7.	SURFACE CASING	1,744,603		114.0
8.	INTERMEDIATE CASING	830,728		60.0
9.	CEMENT & SERVICES		248,150	65.0
10.	RIG= DAY RATE $12,000 X 280 DAYS		3,360,000	
11.	RIG= MOBIL RATE $9,500 X 24 DAYS		228,000	
12.	FUEL 462,000 GAL. @$0.95/GAL.		438,900	204.25
13.	BITS & REAMERS		367,345	6.0
14.	FISHING		38,000	0.5
15.	MUD & CHEMICAL		2,152,746	604.5
16.	WATER WELL (1,000 FT.)		80,310	10.0
17.	LOGGING		368,962	1.5 H
18.	D.S.T.		31,500	0.5
19.	CORING		25,000	0.5
20.	GEOLOGICAL		124,000	
21.	ENGINEERING		47,000	
22.	SUPERVISION 425 DAYS @$680/DAY		289,000	
23.	STAGING AREA LABOR 3 @$25,000/YR.		75,000	
24.	MUD LOGGING		328,500	0.5 H
25.	CAMP & CATERING 55 MEN		738,800	9.75
26.	RENTALS (SURFACE) MUD CLEANER		82,125	1.0
27.	RENTALS (SUBSURFACE) STABILIZERS		207,210	8.5
28.	SAFETY/ENVIRONMENTAL		122,375	1.0
29.	CONTINGENCIES @10%	258,533	993,792	
30.	PLUG & ABANDON		75,000	
31.	HELICOPTER CHINOOK			
	FERRY TIME 20 HRS. @$7,000/HR.		140,000	
	FLIGHT TIME 16 HRS. @$7,500/HR.		120,000	
32.	HELICOPTER BELL 214		1,600,000	RESUPPLY 491.0
33.	CONTINGENCY (HELICOPTER) @10%		186,000	
	DRY HOLE COSTS	$2,843,864	$13,052,715	TOTAL DRY HOLE $15,896,579
34.	PRODUCTION CASING	49,876		2.0
35.	CEMENT & SERVICES		15,700	1.5
36.	PRODUCTION TUBING	290,912		8.0
37.	TOOLS, RENT & PURCHASE	5,000	45,000	.25
38.	ARTIFICIAL LIFT EQUIPMENT	100,000		.25
39.	CHRISTMAS TREE	174,000		.75
40.	RIG TIME 60 DAYS @$2,000/DAY		720,000	
41.	CORRELATION LOSS		50,000	
42.	PERFORATING		75,000	
43.	STIMULATION		300,500	1.50 H
				12.0
44.	EQUIPMENT RENTAL		25,000	.25
45.	TRUCKING	10,000	15,000	
46.	FLUID		150,000	28.0
47.	ENGINEERING 20 DAYS @$500/DAY		10,000	
48.	SUPERVISION 60 DAYS @$680/DAY		40,800	
49.	FLOWLINE	5,000		.25
50.	TREATER	20,000		.25 H
51.	STOCK TANKS	60,000		.75
52.	VALVES & METERS	15,000		.25
53.	TANK BATTERY INSTALLATION	15,000		1,700 HRS. BELL 214
54.	CATERING		$7,000	9.5 HRS. CHINOOK 234
55.	CONTINGENCY @10%	74,479	150,400	(USE 16 HRS.)
56.	HELICOPTER COSTS		INCLUDED IN DRY HOLE COSTS	
	COMPLETION COSTS	$ 819,267	$ 1,654,400	TOTAL $2,473,667
	TOTAL COMPLETED WELL COST	$3,663,131	$14,707,115	
				GRAND TOTAL COMPLETED WELL $18,370,246

APPENDIX F

PREPARERS AND CONTRIBUTORS

(* indicates the four principal authors of this document)

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U.S. Forest Service—Continued		
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Steven C. Lau	Cultural resources	B.A., Archeology, University of South Alabama

Name	EIS responsibility	Education
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William N. Taber	Mobilization of drilling operations	Prof. Biol., Biology, California State University
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Land Management Services		
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David R. Senf	Recreation	M.S., Economics, Colorado State University; B.S., Economics, University of Montana
Peter M. Jorgensen, Consulting Engineer and Land Surveyor		
Robert E. Frost	Transportation	B.S., Civil Engineering, University of Illinois
Peter M. Jorgensen	Transportation	B.S., Civil Engineering, Bucknell University
Stanley Zaist	Transportation	B.S., Civil Engineering, Tufts University
Wildlife Biologist		
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John H. Hoak	Wildlife	B.S., Environmental Science, Allegheny College
Terry L. Peterson	Wildlife	B.S., Zoology, University of Montana
Wirth Associates		
Mark Figley	Recreation	B.S., Natural Resources Management, Colorado State University

Name	EIS responsibility	Education
Wirth Associates—Continued		
Carl Thuesen	Recreation	B.L.A., Landscape Architecture, State University of New York; B.S., Forestry, State University of New York
Wyoming Research Corporation		
James G. Thompson	Socioeconomics	Ph. D, Sociology, University of Illinois; M.A., Sociology, University of Illinois; B.S., Sociology, Occidental College
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APPENDIX G

ROADING GUIDELINES

FOR OIL AND GAS

EXPLORATION AND DEVELOPMENT

ON NATIONAL FOREST LANDS

Prepared by _____ _____
Forest Engineer Date

Approved by _____ _____
Forest Supervisor Date

Prepared By
Bridger-Teton National Forest
1980

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INTRODUCTION

The Bridger-Teton National Forest contains a wide variety of environmental units, ranging from the semi-arid foothills to the plush mountain meadows and high alpine peaks. Underlying the Forest are an abundance of mineral deposits, including coal, oil, gas, uranium, precious metals, and other marketable minerals. The activities of locating and developing these resources has the possibility of creating surface disturbances in virtually every section of the Forest.

The efforts to locate still undeveloped mineral resources and to further identify the limits of known reserves is accelerating with the ever increasing demands for energy fuels. These guidelines detail the requirements of oil and gas enterprises requiring use of the existing Forest Development Road system or construction and reclamation of roads to presently inaccessible areas. Through proper application of the guidelines, the exploration and development of oil and gas reserves can be accommodated with minimal environmental impacts.

THIS DOCUMENT SUPERCEDES THE BRIDGER-TETON INTERIM ROAD STANDARDS PREPARED AND RELEASED FOR USE ON 10-12-77.

The drawings and standard plans attached to these guidelines are to be used in the design where appropriate.

APPLICABLE ROAD STANDARDS

The primary road access that an operator will be using will be either a Forest arterial, collector, or local road, or combination of these. In most cases, the actual work site will be some distance removed from the nearest road. The operator may gain access to the work site by locating, designing, and constructing a "temporary road" from a Forest development road to the work site.

The existing Forest roads are usually inadequate to facilitate the type and volume of traffic required for exploration and/or development of oil or gas reserves. Prior to use by an operator, the road must be upgraded at the operator's expense to a standard compatible with the proposed road use and Forest road classification.

FOREST DEVELOPMENT ROADS

Arterials - A Forest arterial shall be a double-lane, graded, drained, and surfaced road. The roadbed shall be crowned on tangents and super-elevated on curves. The traveled way shall be between 20 and 24 feet in width, depending on the total anticipated traffic and environmental considerations on a site specific basis. The minimum surface depths on all roads shall be four inches of crushed aggregate base or six inches of pit run gravel. The typical cross section for a double-lane road is as shown in the "typical sections." Culverts or bridges shall be installed at all minor stream crossings.

Collectors - A Forest collector shall be either a 14 foot single-lane road with turnouts or a 20 to 24 foot double-lane road. The anticipated traffic volumes will be the basis for determination of the particular standard for a

specific road. In many instances, the operators proposed additional traffic will be sufficient to require upgrading the existing road to a higher standard. If the projected average daily traffic (public, commercial, administrative, operator) exceeds 100 vehicles per day, a double-lane facility will be required.

Locals - A Forest local road shall be a 14 foot wide single-lane road with intervisible turnouts.

Before construction, the Forest Service will determine if the road will be obliterated and reclaimed at the completion of the exploration work, assuming a dry-hole is encountered, or whether it will be retained by the Forest Service and added to the Forest Development Transportation System. In the latter instance, the road will be constructed with turnouts. However, if it is not to be retained, it may be constructed without turnouts depending on the operator's proposed activities and Forest Service recommendations as to management.

TEMPORARY ROADS

The term "temporary road" should not be interpreted to imply a lesser standard of construction. "Regional policy is to require that road access to drill sites be properly located, designed, constructed, and maintained by the leasee and/or drilling operator." Such things as Forest Service directional signs, bridge guardrails, and reduced numbers of turnouts (with appropriate management guidelines) can be designed. A temporary road will be obliterated, if the hole is dry, to requirements that will be described in the EA process.

PERIOD OF USE

The complexities of drilling in the overthrust require that the design of roads accommodate all seasons of use unless the operator is willing to accept road closures due to weather. This means designing roads for all-weather access from frost heave to wet soils to dry conditions. The surfacing requirements on any road used by the operator will be dependent upon the type of soils on which the road is constructed. If snow removal will be required on graveled surfaces, additional thickness for anticipated loss must be included.

ROAD LOCATION

Access to work sites may require the construction of temporary roads and/or reconstruction of Forest Development Roads. Proper initial location of these roads will expedite approval of operator's lease or permit. Some of the factors which must be considered during location are:

Environmental Considerations - Select wildlife habitat, riparian zones, unstable soil areas, threatened and endangered plant locations, side slopes over 40 percent, wetlands, archaeological sites, and watershed areas should be avoided when possible during location studies.

Geotechnical Considerations - Unstable areas, potentially unstable areas and areas showing evidence of high moisture or free water should be identified and avoided. Soil classification samples should be collected and processed during

this period for future road surfacing determinations. Aggregate sources should be identified, tested, and mapped. Roadway excavation areas should be tested to determine the steepest stable cut slopes that could be constructed.

Geometric Considerations - The geometric standards for each particular road must be considered during location. The standards are shown in Table III.

PRELIMINARY SURVEYS

The preliminary survey shall closely traverse along a line previously flagged by the operator and approved by the appropriate Forest Service representative. Certain areas such as benches, wet areas, etc. may require exact conformance to flagged lines. Bisecting cross sections shall be taken at breaks in terrain, drainage areas and at 100 foot intervals sufficiently wide to cover the entire clearing limits of the future road. Complete terrain cover, drainage systems, soil type, and land ownership shall be noted during P-Line Survey. A complete site survey shall be made at each major stream crossing. Any existing facilities, either operating or abandoned, crossed by the P-Line shall be documented by station and orientation. Examples are powerlines, pipelines, roads, trails, fences, etc.

The class of survey required shall be defined by the Forest Service Engineer.

DESIGN

Roads shall be designed by or under the direct supervision of a Registered Professional Engineer. As in survey, design standards and techniques should be modified to be consistent with the prescribed end product. Techniques may vary from (1) a full design with complete plans and profiles, (2) a line diagram and typical cross section, and (3) field staking of drainage facilities or spot surfacing along a generally acceptable in-place facility.

General geometric design criteria are shown in Table III.

Roads should be designed with the purpose of fitting the roadway to the terrain. This procedure will result in minimized earthwork and disturbed area. The designer shall attempt to create a balanced earthwork project, thus avoiding borrow areas and waste areas. Special care must be taken to compensate for the incremental grade on all switchbacks by holding a maximum centerline grade of four percent throughout the length of the switchbacks.

Slope Selection - The cut and fill slopes shown in Table II, should be used as a guide only. The slopes shall be adjusted to uneven ratios in transition sections to prevent a zigzag appearance at the slope catch points. The top of cut or toe of fill line should be a smooth line with gentle curves. Slope ratios shall not exceed the maximum stable slope as determined by the geotechnical investigation. In areas where cut or fill will be the construction method, cross sections will be required in the plans.

TABLE III

Guide for Minimum Geometric Design Standards
for
Oil and Gas Roads
(FDR and Temporary Roads)

	Single Lane Roads			Two Lane Roads		
Anticipated ADT	Less Than 100			Less Than 250	250-500	Over 400
Design Speed	10	15	20	30	30	30
Horizontal Curvature	58°	53°	29°	15°	15°	15°
Radius	75+	100	200	380	380	380
Traveled Way	14	14	14	20-24	20-24	24
Super-elevation	Remove crown			AASHO Blue Book Guides		
Runoff Distance			50			
Crown (Graveled)	Outsloped 2%			2%		
(Paved)				2%		
Stopping Sight Distance	50	85	120	200	200	200
Maximum Grade	8%			8%		
Maximum Pitch	10% for 500'			8%		
Turnout Spacing	Intervisible 1/			Not Required		
Drainage Dip or Culvert Spacing	$D = 300/p^{0.40}$ *			- - - -		
Curve Widening	400/R			400/R		

* D is the distance in feet between installations.

P is the road grade in percent.

+ Unless specifically approved on a site specific basis, the minimum radius of curvature shall be not less than 75 feet.

1/ Intervisible unless EA process, management concerns, or terrain features dictate otherwise.

TABLE II

Cut and Fill Selection Table

Height	Slope Ratio
0-5	3:1
5-10	2:1
Over 10	1½:1

Pavement Structure - The type and amount (depth) of road surfacing shall be determined by the engineer through a procedure based on projected traffic loadings, bearing capacity of the subgrade soils, and the anticipated loss due to traffic use and maintenance. A further factor which is to be considered is the time period in which the operator will be using the road. Section Period of Use of this document defines the consideration which must be given this factor. The surfacing analysis shall be documented and shall become a part of the "road package" submitted to the Forest Service for review and concurrence. If the minimum surfacing as stated under Forest Development Roads, page 2, for arterials is used, documentation of this determination is not required.

An acceptable analysis may be as simple as comparing like soil types and structure depths (that are based on firm data from previous projects) to full laboratory analysis of subgrade materials using California Bearing Ratio (CBR) or R value tests. The level of analysis should be that necessary to assure the pavement structure depths will support the type of vehicle and volume of use anticipated. The depth of rock courses can be varied along the road to accommodate changes in subgrade bearing capacity.

Traveled Way Width - The width of the traveled way, i.e., the lane width plus shoulder width, is determined from Table III. Accurate traffic projections combined with the design speed of the facility are the determining factors for traveled way widths. The operator should establish the factors even prior to the time when road location efforts are undertaken, and review with and receive concurrence from the Forest Engineer prior to proceeding with the work. This information must be included in the road package when submitted to the Forest Service for review.

Curve widening shall be applied to the traveled way widths as required to accommodate the tracking characteristics of the design vehicle. The design vehicle shall be that vehicle commonly referred to as 3-3 or WB-50.

Clearing - Selective clearing may be required during earthwork to remove trees damaged by the construction, particularly large trees at the top of cut slopes whose root systems protrude into the excavation zone. Care shall be exercised to prevent marring of trees by equipment or rock. The oil company will buy all timber on the road R-O-W.

All cleared material shall be disposed of through methods approved by the Forest Service. Methods which may be approved are burning, burying outside

the construction limits, decking of material for removal by the public for firewood, chipping, sale of merchantable timber to a mill, or other appropriate means as suggested by the operator. The method to be utilized shall be identified in the construction plans and specifications.

Drainage - Permanent drainage structures shall be installed to protect the road and adjacent watershed. Simgle lane roads shall have, as a minimum, armored drainage dips constructed in the roadbed to prevent water from channeling the road surface. Bridges, or occasionally culverts, shall be installed at all live stream crossings. Low water crossings may be constructed in low flow drainages where stream and roadway geometrics permit. Culvert cross-drains shall be installed in all double-lane roads (drainage dips shall not be constructed on double-lane roads). They shall be located to accommodate natural drainage patterns and as ditch relief pipes. Culvert inlet basins will be required to install ditch relief pipes. The inlets shall have metal end sections and occasional elbows to provide proper installation. These pipes will extend to the toe of the fill slopes and erosion control devices or energy dissipators shall be utilized at the outlets.

Dips will be designed so that it will be apparent at the time the road is maintained that the dip is a permanent necessary feature of the road and is not an irregularity that can be smoothed out with a grader. Dips must be designed and not added as an afterthought. Slopes at the discharge point may need protection and should be greater than the slope of the road to prevent dip from filling with silt.

Where large natural drainage systems are encountered, a complete hydrological study of the system must be performed to predict the anticipated runoff.

As a minimum, culverts shall be designed for a 10-year flood (flow of 10-year recurrence interval) without a head at the entrance. They should also be designed to carry a 50-year flood without exceeding the allowable headwater. The allowable headwater is the maximum water elevation for which the resulting flood damages are considered to be acceptable. Major culverts (end area greater than 35 square feet) and minor bridges (spans on the order of 30 feet or less) should be designed for a 20-year flood and checked for a 50-year flood. All other bridger should be designed to pass a 50-year flood and checked for a 100-year flood.

The hydrological study shall be included in the road package upon submittal to the Forest Service for review and concurrence. After the road design is approved, 5 copies of the plans will be prepared and given to the Forest Service.

CONSTRUCTION

Staking - Construction controls will be staked on the ground for all roads. Staking will be in accordance with standard practices and include a marked centerline, P.I.'s, clearing limits, cut and fill stakes, drainage structures, and reference hubs. The degree of construction staking will be determined by the Forest Service engineer. Minimum staking should include a referenced centerline, staked culverts and dips, and the cut catch point on slopes over 40 percent. Construction staking shall be done as described in Forest Service Standard Specifications for Roads and Bridges. NO WORK SHALL COMMENCE UNTIL FOREST SERVICE APPROVAL OF CONSTRUCTION STAKING IS COMPLETED.

Quality Control - The operator has the responsibility to ensure that each road is constructed according to plans and specifications approved by the Forest Service. Forest Service Standard Specifications for the Construction of Roads and Bridges shall be utilized to establish and maintain construction standards. Copies are available from the Forest Supervisor's Office. The degree of construction control should complement the survey and design methods utilized. Lower standard surveys and designs may require more intensive construction engineering to assure an acceptable end product.

The Forest Service will make periodic inspections to ensure that each road is properly constructed, at which time control test and charts maintained by the operator shall be made available for review. This shall include density tests, aggregate gradations, photographs showing construction techniques, daily diaries, etc.

The normally accepted tolerances between the designed and constructed road are as shown in Forest Service Standard Specification 203.

Tolerances should be indicated on the project plans.

Conservation of Topsoil - There may be instances where, in specific locations, topsoil stockpiling may be required. In general, it will not be required for roads. Topsoil quantities will be considered in earthwork quantities.

ROAD MAINTENANCE

The lessee's Operations Plan shall include a maintenance plan for all roads constructed or used by the lessee.

Users of Forest Development Roads shall pay their fair share of maintenance costs, and use of Forest roads will be approved by Forest Service road permits. This includes roads which lead to the area where additional access is needed. Lessees may either perform actual maintenance activities or pay cooperative deposits as the Forest Service approves. Before a bond release is signed, all road damage caused by the user shall be repaired in a manner approved by the Forest Service.

The maintenance plan should have definite provisions for preventing undercutting of cut banks and the unnecessary removal of established stabilizing vegetation on fill side of road (operators should be given special instructions).

OBLITERATION OF TEMPORARY ROADS

Upon abandonment and prior to when a bond release is signed, temporary roads shall be obliterated. All or part of the obliteration techniques that follow could be used depending on the EA direction. Obliteration shall commence by stripping the gravel course from the roadway surface by means of a scraper or by windrowing with a motor patrol and removal with a loader and trucks. The gravel may be stockpiled on the Forest at approved sites. After stripping the ground, obliteration shall consist of rough grading, ripping or scarifying, cross ditching, and opening drainages to prevent erosion and encourage revegetation. The work shall not commence until after the temporary road is no longer needed to serve traffic.

After rough grading and ripping have been completed, the abandoned roadway shall be cross ditched.

Live streams and other drainages shall be opened by removing the abandoned structures and grading the approach fills so they will not impair the stream flow.

Abandoned structures shall be disposed of in agreed locations.

All obliterated areas shall be revegetated by applying seed and fertilizer mixtures as approved by the Forest Service.

Roadways to be obliterated in high scenic quality areas will require more intensive procedures than those described above and may include such work as refilling cut slopes, removing fills, transplanting trees and shrubs, and other techniques deemed necessary to completely restore the area.

Culverts, bridges, construction signs and other materials furnished by the operator will remain the property of the operator on obliterated roads.

PROVISIONS FOR THE CONSTRUCTION OF OIL & GAS

WELL DEVELOPMENT ROADS AND LOCATIONS

Compliance with the following provisions will be a requirement of any Road Use Permit or approved plans for road construction or reconstruction. Failure to comply may result in the Forest Service withdrawing all Road Use Permits and issuing appropriate "Stop Work" orders.

The intent of this agreement is to cover and control all construction on roads and locations on Forest Service administered lands, and is in addition to any requirement and controls by the USGS issued permits.

Section 10 - Bridger-Teton Interim Standards

Permittee shall conform with all requirements of the Bridger-Teton Guidelines for Oil and Gas Development on National Forest Lands.

Section 20 - Inspection by Operator

All road and bridge construction and associated work shall be performed under the inspection of a Professional Engineer licensed in the State of Wyoming. Said Engineer shall certify that all work is accomplished in conformance with the applicable specifications and provisions. Daily Diaries shall be kept and submitted weekly to the Forest Service. The Forest Service will supply the necessary Diary forms if requested. All inspection and testing, and costs related thereto, shall be the responsibility of the operator.

Section 30 - Superintendence by Operator and Forest Representative

The operator, at all times during construction and until work is completed and approved, shall give his personal superintendence to the work or have on the work a competent superintendent, satisfactory to the Forest Service and with authority to act.

The Forest Supervisor will appoint a representative to act on his behalf in the administration of the Forest Service's interests in the road and location construction.

Section 40 - Permits and Responsibilities

The operator shall, without any expense to the Forest Service, be responsible for obtaining any necessary licenses and permits, and for complying with any applicable Federal, State, and municipal laws, codes and regulations, in connection with the prosecution of the work. He shall be similarly responsible for all damages to persons or property that occur as a result of his fault or negligence.. He shall take proper safety and health precautions to protect the work, the workers, the public, and the property of others. He shall also be responsible for all materials delivered and work performed until completion and approval of the entire construction work, except for any completed unit of construction which may have been approved.

Section 50 - Suspension of Work

The Forest Supervisor may order the operator in writing to suspend, delay, or interrupt all or any part of the work for such period of time as may be determined to be appropriate for the convenience of the Forest Service.

Section 60 - Surface Replacement

Operator shall submit to the Forest Service a projected plan of truck haul of surfacing or other materials for the duration of his entire operating time. The Forest Service will use this data to calculate the maintenance costs to be assessed to the operator. Operator shall make a Required Deposit for this amount to the Forest Service to cover the costs of the surface replacment, unless the Forest Service allows operator maintenance.

Operator shall notify the Forest Service of any changes made in the hauling volume so that a revised assessment can be made. If the Forest Service does not feel that the operator has made a reasonable and true estimate of traffic volume, the Forest Service may at its option require the operator to submit a revised estimate or elect to produce the estimate itself.

Section 70 - Dust Abatement

Prevention of excessive dusting of road surface materials shall be accomplished by application of _____ by the Purchaser. Such application will be performed from (station) (or mile post) _____ _____ to (station) (or mile post) _____ (on the _____ Road, No. _____) in the vicinity of the _____. Operator shall exercise due care in the use of oils to avoid contamination of water or excessive damage to vegetation.

Section 80 - Control of Work

1. Conformity with Drawings and Specifications. Unless working tolerances are specified, all work performed and materials furnished shall be in reasonably close conformity with lines, grades, cross sections, dimensions, and material requirements shown on the drawings, indicated in the specifications, or designated on the ground. "Reasonably close conformity" is compliance with reasonable and customary manufacturing and construction tolerances.

2. Rights In and Use of Materials Found or Produced On the Work.

   A. The operator, with the written approval of the Forest Supervisor, may use on the project suitable stone, gravel, and sand, or other material found in the excavation.

   B. Materials produced or processed from Government lands in excess of the quantities required for performance of this contract are the property of the Government. The Government is not obligated to reimburse the Contractor for the cost of their production.

3. Local Material Sources.

A. Designated Sources - Sources of local materials on Forest Service lands shall be designated in writing by the District Ranger and shall be shown on the drawings. The Government assumes no responsibility for the quality and quantity of material in the source. The operator shall determine the equipment and work required to produce the specified product. The operator shall submit a pit plan and rehabilitation plan to the Forest Service for approval prior to using any local source.

The operator shall utilize all suitable material in the source. The designation of source will include the rights of the operator to use certain area(s) for plant site, stockpiles, and haul roads. Any operator royalty payment requirements will be stated in an addendum to these provisions.

B. Operator Furnished Sources - when the material sources are not designated as provided above or the operator elects not to use designated sources, the operator shall be responsible for providing the specified product. Quality testing shall be the responsibility of the operator. Test results shall be furnished to the Forest Supervisor.

4. Storage and Stockpiling of Materials. Materials shall be stored to assure the preservation of their quality and fitness for the work. Stored materials shall be located to facilitate their prompt inspection. Sites on Forest Service administered land, approved by the Forest Service, may be used for storage purposes and for the placing of operator's equipment. All storage sites provided by the Forest Service shall be restored at operator's expense. Operator shall be responsible for making arrangements for storage on other than Forest Service administered lands.

5. Cleanup. Premises shall be kept free from accumulation of waste materials, rubbish, and other debris resulting from the work. Before final acceptance all rubbish, waste materials, temporary structures, and equipment, shall be removed from roadway, borrow pits, quarries, and all Forest Service administered land occupied by the operator in connection with the work.

6. Samples, Tests, Cited Specifications. Reference made in the plans to specifications, standards, or test methods adopted by AASHTO, ASTM, GSA, or other recognized national technical associations, shall mean specifications, standards, or test methods (including interim or tentative issues) which are in effect on the date of the solicitation. Operator is responsible for all tests to be performed. Tests shall be performed under the direction of a Professional Engineer licensed in the State of Wyoming.

Section 90 - Prosecution of Work

A. The operator shall, when deemed necessary by the Forest Service and within 10 days after request, file with the Forest Supervisor a time

schedule of proposed progress, a plan of operation, and a proposed detailed method of performing the work. This shall include a full statement of the equipment layout for the project, a method for temporary and permanent erosion control, and protection of wildlife or fish habitat. When the operator deviates from the current schedule, the Forest Supervisor may require a revised schedule for the remaining work.

B. The Forest Supervisor may require the operator to finish work in progress before new work is started.

Section 100 - Legal Relations and Responsibilities to the Public

1. Use of Premises.

A. Before any construction camp, quarry, borrow pit, storage, detour, or bypass site, other than shown on the drawings, is opened or operated on National Forest land or lands administered by the Forest Service, written permission shall be obtained through the Forest Supervisor. A camp is interpreted to include the camp site or trailer parking area of any employee working on the project for the operator. Such permission, if granted, will be without charge to the operator.

B. Sanitation Facilities - Unless provided otherwise, the operator shall provide and maintain sanitation facilities for the work force at the site of road construction. Solid waste shall be disposed of in accordance with applicable Federal, State and local regulations.

2. Protection and Restoration of Property and Antiquities.

A. Public and private property along and adjacent to the project shall not be damaged and monuments and property markers shall not be disturbed until the Forest Supervisor has witnessed or otherwise referenced their location. Any property or facility damaged or destroyed shall be promptly repaired or replaced at the operator's expense.

B. If remains of prehistoric people's dwelling sites or artifacts of historical or archeological significance are encountered in the work, the operator shall discontinue work and notify the Forest Supervisor immediately.

3. Landscape Preservation.

A. Prevention of Landscape Defacement. The operator shall not remove, deface, injure, or destroy trees, shrubs, or natural features unless specifically authorized. The operator shall confine operations to within the clearing limits or other areas designated in the plans, and prevent the depositing of rocks, excavated materials, stumps, or other debris outside of these limits. Material which falls outside of these limits shall be retrieved, disposed of, or incorporated in the work as directed by the Forest Supervisor.

B. Layout and Restoration of Temporary Access. Unless provided for in the plans, temporary construction including access to pits and quarries must be authorized in writing by the Forest Supervisor. When the construction of the portion of the project for which they are required is completed, the natural surfaces of all such areas shall be restored as nearly as practicable to their original condition.

4. Control of Erosion, Sedimentation and Pollution. Operation shall be scheduled and conducted to minimize erosion of soils and to prevent silting and muddying of streams, rivers, irrigation systems, and impoundments (lakes, reservoirs, etc.).

   Pollutants such as fuels, lubricants, bitumens, raw sewage, and other harmful materials shall not be discharged into or near rivers, streams, and impoundments or into natural or manmade channels leading thereto. Wash water or waste from concrete or aggregate operations shall not be allowed to enter live streams prior to treatment by filtration, settling, or other means sufficient to reduce the sediment content to not more than that of the stream into which it is discharged.

   Mechanized equipment shall not be operated in live streams without approval by the District Ranger.

5. Operator's Responsibility for Utilities. The operator will notify all utility companies or other parties affected and make arrangements for all necessary adjustments of the public or private utility fixtures, pipelines, and other appurtenances affected by the construction. Work shall not begin until all necessary arrangements to prevent damage have been made.

6. Barricades, Warning Signs, and Other Devices. The operator shall provide, erect, and maintain all necessary barricades, suitable and sufficient lights, danger signals, signs, and other traffic control devices, and shall take all necessary precautions for the protection of the work and safety of the public. Roads closed to traffic shall be protected by effective barricades, and obstructions shall be illuminated during the hours of darkness. Suitable warning signs shall be provided to properly control and direct traffic.

   The operator shall erect warning signs in advance to any place on the project where operations may interfere with the use of the road or trail by traffic and at all intermediate points where the new work crosses or coincides with an existing road or trail. All road barricades, warning signs, lights, temporary signals, flagmen and pilot car operators and equipment, and other protective devices, except for special devices, shall conform with Part VI of the Manual on Uniform Traffic Control Devices for Streets and Highways, published by the Federal Highway Administration and applicable safety codes.

   The operator shall furnish, erect, maintain, and remove when notified any project identification signs shown on the drawings.

TD 195 .P4 C32 1981 c.2
88056792
Cache Creek-Bear Thrust
environmental impact

BLM LIBRARY
BLDG 50, ST-150A
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, COLORADO 80225

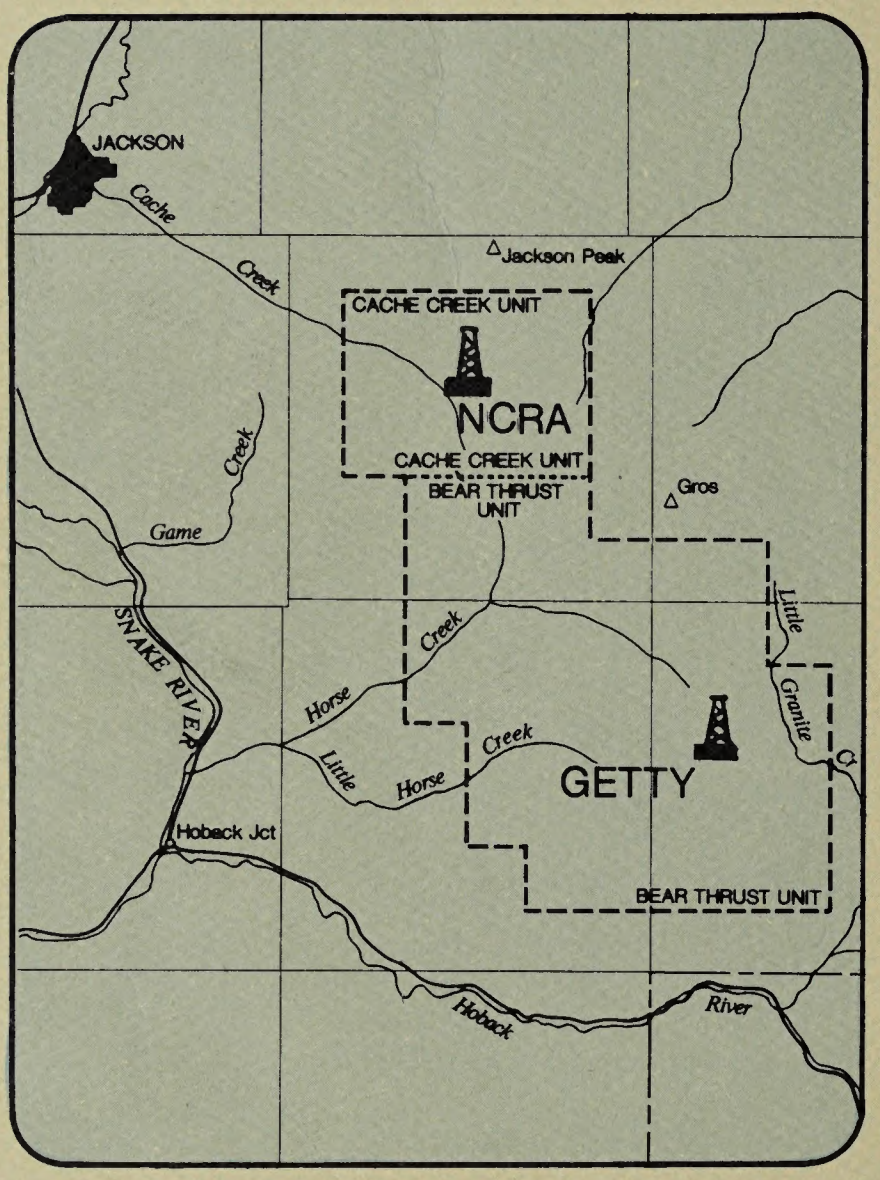
TD 195 .P4 C32 1981 c.2
92
-Bear Thrust
tal impact

OFFICE	DATE RETURNED

(Continued on reverse)

ER'S CARD

Applicants:

NATIONAL COOPERATIVE REFINERY ASSOCIATION (NCRA)

GETTY OIL COMPANY